Developing a Critical Dialog for Educational Technology:

Understanding the Nature of Technology and the

Legacy of Scientific Management in Our Schools

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Abstract

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This dissertation examines the legacy of scientific management and the dominance of one-dimensional thinking in the field of educational technology. Through this analysis, I demonstrate that the ways practitioners and policymakers frame educational technology, assess its effectiveness, and make judgments about its potential, often exclude essential reference points such as the origins of the field, the nature of technology and alternative critical frameworks. In order to properly evaluate educational technology, it is necessary to unpack and explore the historical, moral, and political motives that frame current thinking in the field. To that end, the ideas of the father of scientific management, Fredrick W. Taylor, and critical theorist, Herbert Marcuse, were examined around five themes: truth, human nature, relationship to society, nature of technology, and the aims of education. These themes were then applied to a textual analysis of the National Educational Technology Plans from 1996 through 2010 to demonstrate the prevalence of techno-rational language in recent national educational

technology policy. The conclusion identifies ways for policymakers and practitioners to recognize and critically engage with techno-rational thought and the nature of technology in the field of educational technology.

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CHAPTER I

INTRODUCTION

> Whether or not it draws on new scientific research,
>
> technology is a branch of moral philosophy, not of science.
>
> (Goodman, 1970, p. 40)

The previous statement was written by scholar and social critic Paul Goodman over forty years ago. It was written at a time when technology, science, and social-political structures— such as education—were all under sharp criticism by a growing number of philosophers and academics (Adorno, 1992; Horkheimer, 1985; Lukács, 1971; Marcuse, 1991). How is a 40-year-old declaration by a social critic relevant to a discussion of technology in education today?

To understand how this statement is relevant to the field requires an unpacking of several key assumptions that surround current thinking in the field of educational technology. So what are some of the key underlying assumptions in the field of educational technology? Many educational policy makers and practitioners believe that technology is a powerful and necessary tool for education, a sign of progress and hope. This belief is clearly reflected in the way technology in education is framed. For instance, take the language used by the International Society for Technology in Education (ISTE). In a recent statement, ISTE outlined their priorities for the upcoming year stating, "Technology in education remains the backbone of school improvement" (ISTE, 2010). Moreover, "education technology must permeate every corner of the teaching and learning process" (ISTE, 2010).

These are powerful statements given ISTE is one of the largest educational technology associations for educators and education leaders. Founded in 1979, ISTE represents more than 100,000 educational leaders in over 80 countries. In addition, ISTE publishes four professional journals, hundreds of books and hosts several annual conferences (ISTE, 2012a). Theses conferences are widely attended with one recent conference exceeding 20,000 attendees (ISTE, 2012b). ISTE also established the widely adopted National Educational Technology Standards (NETS) for students, teachers, and school administrators and has ties to over 80 affiliate organizations (ISTE, 2012c).

Similar beliefs about the power of technology in education are echoed by other national organizations such as the Partnership for 21st Century Skills (P21). P21 is national advocacy group focused on outlining key skills for all students to compete in a global economy (21st Century, 2012a). As part of their mission, P21 promotes the idea that technology should play a primary role in informing other education efforts such as No Child Let Behind (NCLB), science technology engineering mathematics (STEM) initiatives, and high school reform to name a few (21st Century, 2010). The P21 authors argued that policymakers should, "Integrate technology as a part of every program and initiative for the effective and efficient implementation of a 21st century education system" (21st Century, 2010, p.16). Both ISTE and P21 are intent on rapidly increasing the adoption of technology in schools.

At first, these statements seem quite reasonable. Similar statements have been part of the discourse in the field of education for years. However, if one begins to critically analyze these statements, several significant questions begin to surface. For instance: What do these statements assume about the goals and purposes of education?

What are ISTE and P21 claiming will be the benefits of increased use of technology? Who would likely benefit from the technology and who would be marginalized? Are there any material or substantive costs or trade-offs or unintended consequences in the pursuit of such a technological path? If so, what are they?

While new technological innovations continue to find their way into classrooms, introduced with the intent of changing the ways we teach and learn, recent critiques of educational technology have fallen short in several important ways. While there have been critical discussions about technology in schools, the vast majority are limited to measurable learning outcomes or an institution's ability to afford, adopt, or properly implement a technology. This seems reasonable given the rationale for technology in schools often involves beliefs centered on making schools more productive and efficient. Policy makers look to the gains achieved in business and industry with technology to justify the widespread adoption of technology in schools. Take for instance the 1996 National Education Technology Plan authored by the U.S. Department of Education. In the plan the authors stated, "Every major U.S. industry has begun to rely heavily on computers and telecommunications to do its work. But so far, America's schools have been an exception to this information revolution" (USDOE, 1996, p. 11). Other organizations made similar claims. The Partnership for 21st Century Skills stated that, "Our nation's education system must join the ranks of competitive U.S. industries that have made technology an indispensable part of their operations and reaped the benefits of their actions" (P21, 2012b, p.3). Given the connection to business and industry and a focus on the productivity and efficiency associated with technology, it is not obvious to the casual observer that there are deeper and potentially more important questions concerning technology in schools that have yet to be adequately explored.

Marcuse (1991) referred to this type of technical and scientific thinking as one-dimensional thinking; other authors have referred to it as techno-rational thinking. On a basic level, this type of one-dimensional thinking prioritizes quantitative data to drive decisions. Over time, one-dimensional thinking in educational technology has become normative, considered appropriate, and in accordance with best practice.

Why is this problematic? The ways in which educational technology is currently framed, effectiveness assessed, and judgments made about its potential, are grounded in one-dimensional scientific thinking coupled with a belief in technological progress. As a result, essential reference points such as the origins of the field, the nature of technology, and alternative critical frameworks are often excluded. Additionally, these reference points are infrequently addressed in the academic literature and arguably would aid educational technologists in making more informed choices. Without these alternatives, the field of educational technology has been largely confined to one-dimensional thinking around issues of technology in education. This dissertation aims to expose the origins and influence of one-dimensional thinking in educational technology.

In order to properly evaluate educational technology and delve into more critically oriented questions, it becomes necessary to unpack and explore the historical, moral, and political motives that frame current thinking in the field. It is only through this exploration of ideas that alternative possibilities can begin to be elucidated. It is important to recognize that alternatives to current thinking will seem counterintuitive and counterproductive to many in the field. Often the normative thinking in the field follows a pattern of "if we can, we should." In fact, many people are convinced that technology in and of itself is a sign of progress; furthermore, to be left outside the influence of technological progress is a sign of inferiority. Stakeholders argue high-tech or wired schools offer a more productive and efficient, higher quality educational experience than their low-tech counterparts.

Unpacking this one-dimensional thinking is problematic because one-dimensional thinking literally drives how things ought to be framed in the field. To escape its influence takes radically different ways of thinking about the history, aims, and assumptions of technology in education. Only then can it be hoped that tensions between current thinking and potential alternatives will be revealed.

A broad search of the academic literature in educational technology revealed that with a few exceptions, the historical, moral, and philosophical aspects of technology in schools are largely ignored or unnoticed. The scope and nature of this critically oriented literature will be discussed later in chapter one. Presently, several examples of current one-dimensional thinking in educational technology will be explored. Before advancing it is important to note that in many ways we continue to utilize the very tools we are attempting to critique as the primary means of critique. This one-dimensional thought manifests in several important ways, as can be seen in how history of the field is approached. Many historical studies of educational technology read merely as a recitation of technological inventions. Dates and models of each new technology as well as new teaching methods are well documented, but do not include a more complete analysis of the social and political forces that worked to bring them into the classroom.

As a result, these investigations neglect to adequately address key assumptions about the technology and the forces at work to get them adopted in schools.

For example, Saettler's reference (1990), *The Evolution of American Educational Technology*, was first published in 1967 and updated in 1990. Saettler's aim was to trace the "theoretical methodological foundations of American educational technology" (1990, p. xxvii). While Saettler spent the first few chapters linking the field of educational technology to early educational theorists such as Socrates and Dewey, he failed to address other key theoretical foundations and political events that greatly influenced technology in schools. Instead, his first few chapters read more like a pedagogical justification for various types of technology. Choosing to use this type of research lens severely limits any historical investigation and it could be argued that this results in a grossly inadequate analysis. Unfortunately, many consider Saettler's work to be a classic reference for those in the field of educational technology.

In 2001, Reiser published a two part series entitled, *A History of Instructional Design and Technology.* In part I, Reiser (2001a) briefly defined the field into two interrelated parts: instructional design and technology. He went on to discuss the history of educational technology from the early 1900s to the present day. Among his historical touch points were filmstrips, radio, television, computers, and the internet. In fact, he relied heavily on Saettler's work, among others, to paint a historical picture of educational technology in America. Reiser (2001a) concluded with predictions regarding the effect computers, the internet, and other digital media would have on learning and teaching in the future.

In part II, Reiser (2001b) focused more on the history of instructional design. One would think this would be an appropriate place to analyze the underlying assumptions or thinking around the method and technology being used by early instructional designers. He began by identifying World War II as the beginning of instructional design. During this time large number of soldiers needed training in various aspect of military life. The impetus, he argued, was "how to train effectively and efficiently large numbers of individuals with diverse backgrounds" (Reiser, 2001b, p. 57). In one sense he was correct. The field formally took shape during World War II, but the foundation was laid much earlier. In his closing paragraph Reiser argued:

> In the field of instructional design and technology, those whose work is influenced by the lessons learned from the history of media *and* the history of instructional design will be well-positioned to have a positive influence on future developments within the field. (2001b, p. 64)

Broadly speaking, I could not agree more with his point. However, I believe the scope of his investigation was too narrow. By focusing primarily on the historical touch points it excluded an analysis of the assumptions that ground the field and as a result limited our ability to critically engage it.

Unfortunately, Saettler (1990) and Reiser (2001) analyzed the history of the field without adequately investigating the historical events prior to World War II that fueled the early adoption of technology in education. In addition, they focused on dates and movements rather than engaging with the historical and political assumptions surrounding technology in education. In failing to do so, they fell short of adequately understanding the origins of the field. It is only by extending the literature review beyond the traditional historical accounts of educational technology that a more complete analysis and critique that attempts to include these historical and political motivations begins to emerge.

One example of this type of critique was the work of Cuban from 1984 through 2001. Cuban's work took a different approach from previous attempts. He approached his critique from the point of an historian rather than a technician and extended his investigation beyond simply listing inventions and dates. In his book, *Teachers and Machines: The Classroom Use of Technology Since 1920,* Cuban (1986) sought to build a more complete narrative around early educational technology and its subsequent adoption in schools. In his own words, he planned to "reconstruct the hoopla and actual teacher usage" of educational technology (Cuban, 1986, p. 6). He was more interested in telling the story from the perspective of school teachers and administrators who were the targets of early technology adoption. He described the tension between educators and technology as a "fickle romance" (Cuban, 1986, p. 4).

While Cuban (1986) hinted at the idea that there may have been certain ways of thinking that grounded early technology in schools, and even mentioned the scientific management movement, he spent a scant paragraph on the topic before moving on. Briefly, the scientific management movement was a system of shop management instituted at the dawn of the twentieth century by Fredrick W. Taylor. Taylor used scientific studies to make manufacturing and labor process more productive and efficient (Taylor, 2011). It is useful to think of scientific management as a direct reflection of the techno-rational or one-dimensional thinking discussed previously.

For Cuban (1986), the history of technology in schools was an unrelenting cycle of invention, claims, and classroom implementation that often resulted in dismal outcomes. In his mind, the primary issue is how we think about school reform, not understanding the legacy of the scientific management movement. He argued we should reject the shortsightedness that often accompanies technology in schools and instead focus on identifying enduring devices that stand up to the test of time and effect real change.

Throughout his book, Cuban (1986) came close to exposing the deeper philosophical issues that surround technology in schools. For instance, he commented that “few scholars, policy makers, or practitioners ever questioned the claims of boosters or even asked whether the technology should be introduced” (Cuban, 1986, p. 5). Unfortunately these comments, and others like it, were more of a stepping-stone rather than a formal investigation of the underlying claims or motivations being made by the proponents of technology.

The focus on school reform and technology was continued in Cuban’s later work, *Oversold and Underused: Computers in the Classroom* (2001). Cuban even devoted an entire chapter to, as he put it, “Making Sense of Unexpected Outcomes” (2001, p. 131). While he certainly began to critically engage with the history of the field, he still fell short of explicitly engaging in a discussion around the underlying assumptions and historical movements that brought about more widespread technology introduction in classrooms.

At this point it is worth mentioning other educational historians, not because they properly filled the gap left in the history of educational technology, but because they begin to explore more explicitly the underlying assumptions and ways of thinking that drive particular movements in education. Tyack (1974) wrote extensively about the history of education and educational reform in America. In one of his early works, *The One Best System: A History of American Urban Education,* Tyack (1974) spent considerable time exploring the deeper connection between school reform and scientific management. Moreover, he focused explicitly on the foundations and underlying assumptions surrounding scientific management. Again in his later work, *Managers of Virtue: Public School Leadership in America,* Tyack (1982) continued to critically analyze the forces at play between scientific management and school management. Tyack (1982) argued, "It was on scientific expertise-coupled with new notions of business management- that the new administrative progressives in education placed their chief reliance" (p. 120). This reliance on scientific management was aimed at making educational decisions more scientific. Tyack critically unpacked these connections to scientific management in a way the writers of educational technology history have not. Tyack (1982) continued, "They sought to develop an applied technology of decision making similar to the technologies of production and management that were transforming the bureaucratized cooperate economy . . . it reflected the evolutionary presuppositions of the new-and avowedly scientific-fields of educational history and educational sociology" (Tyack, 1982, p. 120).

Callahan's (1962) work, *Education and the Cult of Efficiency: A Study of the Social Forces that have Shaped the Administration of the Public Schools,* falls along similar lines. His text focused on the efforts of early school reformers to incorporate scientific management in school administration. This shift in mindset, Callahan argued, turned schools into businesses focusing on efficiency.

Clearly there is more work to be done. For too long historical studies of educational technology have neglected to include a more complete analysis of the social and political forces that shaped the field of educational technology in the early twentieth century. When this legacy is acknowledged, it paints a more complete historical picture of educational technology in America. It also exposes another significant limitation in current educational technology research: understanding the nature of technology.

Nature of Technology

Why bother thinking about the nature of technology? Many have argued that technology is detached and neutral, merely a tool. Any effort spent discussing technology's essence should be left to the philosophers. The prevailing common sense view of technology (Feenberg, 1991) would maintain that how a technology is applied determines its value, not the technology. The argument follows that a hammer can be used to build a house, which allows people to stay warm and have their basic needs met, or a hammer can be used to bludgeon a rival to death. In either case, the hammer was just a tool, for good or for bad. This position was supported by Carey (1992) in *Communication as Culture*, when he wrote that "electronics is neither the arrival of apocalypse nor the dispensation of grace. Technology is technology; it is a means for communication and transportation over space, and nothing more" (p. 139). Feenberg articulated this view as instrumental theory. This view "offers the most widely accepted view of technology. It is based on the common sense idea that technologies are 'tools' standing ready to serve the purposes of their users. Technology is deemed ‘neutral,’ without valuative content of its own” (1991, p. 5).

If one agrees with this view of technology as an instrument, then the study of the nature of technology is unproductive and unnecessary. Returning to the previous example, if we substitute the technology, in this case a hammer for a gun, we begin to find that the views of the technology begin to polarize. On the one hand, there is the view that guns do not kill people, people kill people. But, on the other hand, you have those that argue a gun’s purpose extends beyond firing a projectile down a mental barrel. They argue a gun has only one purpose, to kill without discretion. Many of us have forgotten the history of guns, but shortly after their introduction in warfare, a gun was considered by many to be inhumane because it allowed the soldier to take a life without physically engaging in traditional combat. Clearly there is something about a gun that is fundamentally different than just a simple collect of metal parts arranged in a particular way.

This alternative theory is often referred to as substantive theory. Feenberg (1991) argued from this perspective, “that in choosing to use [technology] we make many unwitting cultural choices. Technology is not simply a means, but has become an environment and a way of life: this is its 'substantive' impact” (p. 8). Other substantivists take a similar position. Postman argued that technology redefines “what we mean by religion, by art, by family, by politics, by history, by truth, by privacy, by intelligence, so that our definitions fit its new requirements” (1993, p. 48). If we at least entertain the substantive view of technology, then the study of the nature of technology becomes incredibly important to the field of educational technology.

Fortunately, there is an entire area of philosophical research engaged in thinking about how to properly frame technology. Simply stated, philosophy of technology is a philosophical area focused on studying the nature of technology and its social effects. At the root of this area of research is the notion that technology may not simply be a neutral tool. Thankfully, there is a significant amount of intellectual work that has been done in this area: Borgman (1984, 1992, 1999); Ellul (1964, 1990); Feenberg (1991, 1998); Heidegger (1977); Goodman (1970); Mumford (1934); and Winner (1977, 1986) to name a few.

The theories are as diverse as the theorists. Take the work of Heidegger (1977) as an example. He was focused on the hidden nature of technology's essence. In his most complete work on the subject, *The Question Concerning Technology* (1977) originally published in 1954, he termed this essence *gestell,* an enframing or all-encompassing view of technology's mode of existence. This enframing shapes every aspect of our thoughts and actions. While his ideas are often critiqued, Heidegger firmly believed there was a certain destiny associated with technology. In related work, Heidegger argued, "We must, first of all respond to the nature of technology, and only afterward ask whether and how man might become its master" (1968, p. 235). For Heidegger, inquiry into technology's true essence was essential.

Winner (1977) took a slightly different approach in his book *Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought.* He argued that "the contemporary experience of things technological has repeatedly confounded our vision, our expectations, and our capacity to make intelligent judgments" (Winner, 1977, p. 8). Drawing from numerous theorists, he spent considerable time tracing the origins of various types of thinking about the nature of technology. His work serves almost as a catalog of philosophical thought regarding the nature of technology. Winner (1977) concluded his work with a literary analogy. In reference to the story of Victor, the mad scientist, in Shelly's (1818) *Frankenstein*,Winner wrote, "Victor Frankenstein is a person who discovers, but refuses to ponder, the implications of his discovery" (p. 313). As a result, "Victor's problems have now become those of a whole culture" (p. 313). This analogy warned of a problematic future if we do not acknowledge the nature of technology and work toward thoughtfully directing it to be in line with human values.

Another example is the work of Feenberg (1991). In his book *Critical Theory of Technology*, he provided the groundwork for framing several views around the nature of technology. Fundamentally there are two philosophical problems associated with determining a philosophy of technology. First, should technology be considered either neutral or value-laden? Second, should technology be considered autonomous or humanly controlled? By taking a particular stance with regard to these two philosophical questions, it allows for a common understanding based on certain assumptions assigned with each view.

Technology	Autonomous	Humanly Controlled
Neutral (complete separation of means and ends)	Neutral-Determinism (e.g. modernization theory)	Instrumentalism (liberal faith in progress)
Value-laden (means form a way of life that includes ends)	Substantivism (means and ends linked in systems)	Critical Theory of Technology (choice of alternative means-ends systems)

Figure 1. Feenberg's (2003) theories of technology.

While certainly not exhaustive, this simple matrix offers rich discussion around the possible ways in which we can frame the nature of technology. Regardless of where one might position their view of the nature of technology on the matrix, each position has deep implications for how we approach technology.

Given that education is one of the most important activities we engage in as a society, one would expect to find the work of philosophers of technology tightly woven into the work of educational technologists. Unfortunately, this type of philosophical inquiry rarely makes significant contact with the field of educational technology. For many in the field of educational technology, the notion of technology being more than simply a neutral tool would seem foreign. To think that a human creation could have values of its own or encourage certain types of social effects seems far-fetched. As a result, many in the field of educational technology have never explicitly engaged in thinking about the nature of technology. While a few have made a call for dialog in the field of educational technology, the call has gone largely unheeded. The following section will touch on some of the limited academic literature that has addressed the nature of technology and its implications for the field of educational technology.

In 1994, Blacker argued that our view of technology in education is currently characterized by a "structural ambiguity of common sense" (p. 1). Stated another way, technology is seen as something we simply use, it is morally neutral. How a technology is applied determines its value, not the technology itself. Returning to the common sense argument made earlier, it follows that a hammer can be used to build a structure that allows people to stay warm and have their basic needs met or a hammer can be used to bludgeon a rival to death. In either case we cannot blame the hammer for good or bad.

At the same time we often argue that technology colors our world and we are constantly trying to keep up; technology ultimately shapes our lives. In other words the technology is autonomous. Blacker argued:

> This double aspect of technology—both concealing and revealing—is the rock of insight upon which to build not only descriptions of technology in education, but also the beginnings of a normative theory that decisively links technology with educational experience. (1994, p. 2)

This point was critical for Blacker. Unless we come to terms with this contradiction we are left without true understanding. He closed his essay stating that, "technological devices are not foes here but they do constitute problems. Our task as educators is to make them into enabling ones" (Blacker, 1994, p. 6). Without thinking about the nature of technology we are left to make poorly informed choices in the field of educational technology.

Johnsen and Taylor (1996) made a similar argument in their article entitled, "Instructional Technology and Unforeseen Value Conflicts: Toward a Critique." For Taylor and Johnsen, educational goals and the values that technologies inherently promote are often at odds. They argued,

> It will not be enough to simply study educational technology as an isolated phenomenon that can be understood and manipulated on its own terms. Educational technology is merely a part of the whole technology context of our way of life, a context that needs to be intellectually grasped. (Johnsen & Taylor, 1996, p. 225)

Clearly for Johnsen and Taylor (1996), there was important work yet to be done in the field related to the nature of technology. Educational technology is a powerful tool with far reaching consequences. Its consequences need to be more fully explored, researched and understood from different perspectives.

While a few other examples exist (Bowers 1988, 2000; Postman 1993, 1995), the nature of technology rarely makes it to the educational technology literature. In addition, much of this literature is well over 15 years old. Given the implications, the field would be well served to include this type of philosophical thought as part of a grounding reference point. When a more in-depth historical analysis of the origins of the field is combined with an explicit discussion regarding the nature of technology drawn from the field of philosophy of technology, one can begin to build a more informed base from which to make decisions about technology in education. The main issue is techno-rational or one-dimensional thought excludes these essential reference points. What if upon a more in-depth and complete analysis, one that utilized the historical context of a particular technology coupled with a thoughtful analysis of the nature technology, found that adopting said technology could lead to serious unintended consequences that are counter to the stated aims of education? It stands to reason that given a more complete picture, policymakers and practitioners may not make the same decisions.

While these ideas bring us closer to making more informed decisions, they also expose another gap in the literature. This gap is the need for an overarching framework or theoretical lens, which policymakers and practitioners can apply to educational technology, a lens that as Goodman argued in the opening quote will extend the discussion of technology beyond science and techno-rational thought. This lens must concurrently acknowledge the historical and political forces at work and explicitly address the nature of technology. In the following section I will argue that critical theory is the most appropriate lens for this task.

Model of Critique

One of the difficulties with critical theory is that there are significant variations within the label of critical theory. Broadly speaking, traditional critical theory is primarily interested in social change to emancipate those that are oppressed. Critical theorists tend to focus on historical, political, economic, and social context (Starratt, 1993) and tend to utilize rational, intellectual dialogue to analyze problems of practice (Capper, 1998). Moreover, critical theorists tend to focus their critique on techno-rational thinking as a by-product of the social and political structures at work in society. These discussions serve to identify power structures that dominate and oppress. There are several important themes that surface when educational technology is viewed through the lens of critical theory. Particularly issues of whose economic interest are served when computers are integrated into schooling and in what ways does technology serve to oppress people and groups.

While it could be argued that many authors have written critically about technology in education, few have made the connection to critical theory explicit. Additionally, nearly 10 years have passed since the field has engaged with these ideas. A search of various books and journals reveal that little has being done in this area. It is worthwhile, however, to acknowledge several limited attempts to include this type of thinking in the field of educational technology.

In 1996, Nichols and Allen-Brown published an article that serves as a review of critically oriented theories and how they have been applied to education and educational technology. They argued that:

> Critical theory speaks to many conceptions of educational technology outside the mainstream, critical theory is worth examining in some detail to establish its value in making educational technology more fully understood, meaningful, and even emancipatory. (Nichols & Allen-Brown, 1996, p. 2)

While the article offers a thorough overview, it attempts to cover too much history and variation within critical theory to provide an action plan for educational technologists.

Kellner (2000) stands out as one that has focused on a select few theorists within critical theory as a way to frame educational technology. In his essay he argued:

> A critical theory of technology avoids both technophobia and technophilia. It rejects technological determinism, is critical of the limitations, biases, and downsides of new technologies, but wants to use and redesign technologies for education for democracy and social reconstruction in the interests of social justice. (Kellner, 2000, p. 248)

He drew heavily on the work of Marcuse and others in his vision for technology as an agent for positive social change. Even with Kellner's (2000) contributions, practitioners are still left to spell out the implications of these ideas on their own.

The intended audience for this research is educational technologists. In many ways they are responsible for lobbying for funding, policy development, and technology integration. In short, they are the ones that should be thinking critically about technology in education. Sadly, they are often the least aware of the historical and philosophical aspects of technology in education. This is problematic. Without understanding the underlying assumptions around technology and technology in education, or without having a way to critically analyze those assumptions, we are left with an uninformed view of technology. Given the importance of education and the investment of technology in the process of education, it seems essential for educational technologists to understand these assumptions more critically.

Research Focus

How does the field engage in a more complete understanding of technology's influence in education? Practitioners must begin by widening the scope of their research and dialog to include the existing historical and philosophical research already available in other academic areas. Only then can they begin to create a more complete picture of educational technology's origins and implications.

At the core of this investigation is an acknowledgement that there are different ways to think about the nature of technology and its influence on the field. Without progress on this front, it would be problematic to argue that the other areas are worth addressing or that the aforementioned gaps in the research are truly gaps worth pursuing. Given the limited scope outlined, this project is not concerned with an exhaustive examination of all the ideas, people, places, or actions related to the birth and growth of educational technology over the last century. Nor will it fully develop a critically oriented framework for practitioners. Rather, this dissertation aims to expose the origins and influence of one-dimensional thinking in educational technology. This will be accomplished by initiating a dialog between two contrasting views of technology, one view focused on techno-rational thought and the other view grounded in critical theory in order to more fully engage the field in this type of inquiry.

In order to structure a meaningful dialog between two contrasting views of technology we must locate the positions. It is easy to argue that the current view of technology in the field is best labeled instrumentalism. Taking this position makes technology value neutral and fully under our control. In addition, this position is also convenient for researchers, policy makers and practitioners because it serves to avoid any discussions about the nature of technology before they begin.

Using Feenberg's (2003) model as a tool for locating various views of technology we find that instrumentalism is in fact the most appropriate classification. Simply stated, instrumentalism is grounded in several key assumptions. This position argues that any given technology is value neutral. A tool at our disposal. Concurrently, there is a faith in progress. Technology serves to make us, and the things we do, better. Through objective scientific study we can continually improve on products and processes. It is in this regard that instrumentalism reveals positivist roots.

This view of technology also assumes the doctrine of the technological imperative. Pacey (1983) argued the technological imperative is commonly taken as "the lure of always pushing toward the greatest feat of technical performance or complexity which is currently available" (p. 79). In other words, because a particular technology gives one the capacity to do something, meaning it is technically possible, then this something that either ought to, must, or inevitably will, become a technological reality. For the sake of simplicity it could be thought of as progress or technological evolution.

This view of technology is also explicitly connected to the techno-rational and one-dimensional thought identified earlier.

Many in the field of educational technology might take issue with this type of summary, but when we begin to critically analyze the rhetoric and actions of many in the field we begin to see this view clearly reflected. In the introduction, two powerful advocacy groups in educational technology were cited. A neutral-deterministic view is clearly evident in their statements about technology, “technology in education remains the backbone of school improvement” (ISTE, 2010). Moreover, “technology must permeate every corner of the teaching and learning process” (ISTE, 2010). Given this belief that technology makes education more productive and efficient, it follows there is also a moral imperative of *must* as if to imply that anything else would be unacceptable. Given the prevalence of the view in the field it will serve as one of the focal points for the discussion.

If instrumentalism represents much of the current thinking in the field, then critical theory represents a view that is well suited to provide meaningful contrast with the current one-dimensional thinking. Critical theory is deeply rooted in Marxist thought. Briefly stated, Marxism focuses first and foremost on the relationship between the economic base (capitalism) and superstructures (social institutions such as education). The ultimate goal of Marxism is to resolve class struggle by making those who are oppressed aware of their condition and enact change. Much of the struggle in Marxist thought is tied to what Marx called “relations of production” (Marx et. al., 1932, p. 89). This notion referred to various social and technical relationships involved in the social production and reproduction of material life. It also included the socio-economic control over individuals and the way they produce and reproduce their existence.

How does this relate to current thinking in educational technology? Given the focus on relations of production as Marx conceived it, critical theorists see the instrumentalism and positivism as the dominant features of the modern world.

Before moving forward in our discussion of critical theory, it is important to mention that many modern critiques of instrumentalism utilize a different, subjective set of language. Those unfamiliar with critical theory or this genre of academic work can find it dizzying trying to keep up with the various terms. One issue is that many critically oriented thinkers utilize various terms to reference a similar set of assumptions. This is especially true when referring to instrumentalism. Beginning in the 1960s and 1970s, authors such as Adorno (1992), Horkheimer (1985), and Lukács (1971), formally critiqued instrumentalism referred to by Weber (1993) as instrumental rationality or techno-rational thinking or what Marcuse (1991) later branded one-dimensional thinking. It is not to say there are not subtle or unimportant differences between these terms. It is to say that they refer to a similar set of assumptions.

Additionally, while scholars and thinkers in educational technology may self-identify their view as instrumentalism, they would be unlikely to adopt the same subjective language as critical theorists when referring to their view, primarily because the terms employed by critical theorists are often packaged around unfriendly critiques. Regardless, the value of the critique remains and being aware of the difference in language is important. Moving forward I will attempt to acknowledge these various terms and call out some important distinctions.

Returning to our discussion of critical theory we must begin to unpack the nature of the critique offered by those theorist. For many it begins with the core of their view. Gibson (1986) argued that instrumental rationality,

> is concerned with method and efficiency rather than purposes. Instrumental Rationality limits itself to "How to do it?" questions rather than "Why do it?" or "Where are we going?" questions. It is the obsession with calculation and measurement: the drive to classify, to label, to assess and number, all that is human. (p. 7)

Since techno-rationalists rely on scientific method to justify their views, critical scholars devote considerable space to interrogating scientific explanation of social and human endeavors. One critically oriented scholar stated it clearly when he argued:

> Critical theory holds that scientific (or positivist) approaches to the study of human society are at best ill-conceived, at worst irrelevant or distorting. To use the methods and assumptions of the natural sciences in the study of society is to hamper the pursuit of truth. (Gibson, 1984, p. 4)

Stated another way, critical theorists hold the belief that within the realm of human activities, facts are socially constructed and therefore are value-laden. For many critical theorists this includes all human technical endeavors, as well as technology. For some, this notion may seem foreign, but if one considers that all technology is a human creation, it therefore carries with it the values and power of its creators. From systems of writing to modern computer technology, technologies carry values by what they include or exclude, encourage or discourage. Grounded in the notion that technology is both value laden and operates under a certain level of autonomy if left unconstrained, this position uses the views of critical theorists to both reveal the values of technology and enlighten alternative outcomes. Since critical theory engages explicitly with technology and the techno-rational view of technology it will serve as the second focal point for this conversation.

The number of theories within each of the two positions are as varied as the theorists themselves. For instance, within critical theory, some tend to argue from a fatalistic point of view (Ellul, 1964; Heidegger, 1977) while others are more hopeful (Feenberg, 1991; Marcuse, 1991). Rather than develop an extended dialog between many theorists holding each of the views, this project will compare and contrast the views of two thinkers: Taylor (2011) and Marcuse (1991). These two thinkers were chosen because they represent powerful, divergent ways of thinking about technology and its impact on our society and were firmly grounded in techno-rationalism and critical theory respectively.

Since the adoption of early educational technology was influenced by the scientific management movement adopted in factories during the early twentieth century (Tyack, 1974), the founder of that movement, Fredrick Winslow Taylor, was chosen to represent the techno-rational view of technology. Some 21st century historians have gone as far as to argue, "Taylor's thinking . . . so permeates the soil of modern life we no longer realize it's there" (Kanigel, 1997, p. 7). Unpacking this way of thinking is key and leads to the first guiding research question:

1. What were the main intellectual assumptions behind Taylor's ideas of technology?

In order to understand his work and his view of technology, *The Principles of Scientific Management,* published by Taylor in 1911, will serve as a focal point. This text should provide ample insight to his methods and reveal the underlying assumptions around technology as it was applied to factories and later to schools.

Representing the view of a critical theorist, Marcuse (1991) was chosen because his critique acknowledged the connectedness of the historical, political, and philosophical forces mentioned in the previous sections. In his writings, Marcuse (1991) argued that the development of modern industry and the prevalence of scientific management undermined the basis of individual thought. Marcuse (1991) also viewed technology as value laden and acting in ways we do not readily recognize. As a result of techno-rational thinking and its widespread application, we are left with habits of thought that create a false consciousness, a consciousness void of reason and individuality. In other words, technological systems and technology have the ability to shape us and blind us in ways we cannot readily perceive. Marcuse (1991) found this way of techno-rational thinking deeply problematic. It is this analysis that reveals the second research question:

2. What were the main points of Marcuse's critique of techno-rationality?

While very little of his work spoke directly to education and educational technology, Marcuse (1991) did provide alternatives that can be applied to the field. Marcuse's most complete work on the subject was, *One-Dimensional Man* (1991) and will serve as a focal point for developing the conversation.

With the conversation started, policymakers and practitioners need to understand how this type of thinking is reflected in current policy. As Burbules and Warnick (2006) argued, "part of the purpose for exploring these hidden premises, assumptions, and prejudices is that evaluating an idea, or an entire system of thought, involves evaluating its presuppositions, and its implications as well" (p. 493). This guides the third research question:

3. What are the legacies and implications of their ideas for current issues in educational technology?

In order to answer this question, I will analyze the last four National Educational Technology Plans (NETP). These plans were all published by the Office of Educational Technology under the U.S. Department of Education and authored by a variety of experts in education, technology and business. Each plan was presented to Congress and served as a road map for educational technology policy in schools at the federal level. Placing these NETPs under a critically oriented content analysis was fruitful in illustrating the legacies of techno-rational thought in educational technology.

The first plan, entitled *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge* (U.S. Department of Education, 1996) focused on technology literacy for all students. Four years later, the Office of Educational Technology followed with a plan focused on distance learning. In *E-learning: Putting a World-Class Education at the Fingertips of All Children* (U.S. Department of Education, 2000), the plan outlined five goals to serve as a roadmap for the national strategy for the effective use of technology in elementary and secondary education. The third NETP was authored in 2004. In *Toward A New Golden Age In American Education-How the Internet, the Law and Today's Students Are Revolutionizing Expectations* (USDOE, 2004) the focus was on seven initiatives aimed at achieving and reporting the goals of No Child Left Behind (NCLB) legislation. The most recent plan, *Transforming American Education: Learning Powered by Technology* was published in 2010. This plan acknowledged that technology, "is at the core of virtually every aspect of our daily lives and work, and we must leverage it" (U.S. Department of Education, 2010, p. ix). Critical engagement with the plans will help identify the author's underlying assumptions surrounding technology. The analysis of the four technology plans is not meant to be exhaustive, but rather illustrative.

With an analysis of recent educational technology policy started, it is also important to extend this type of analysis in other meaningful ways so leaders in the field can begin to apply this type of thinking to real world decision-making. This idea framed the fourth research question:

4. How do Taylor's (2011) and Marcuse's (1991) ideas and assumptions about technology compare when applied to emerging educational technologies?

Methodology

Many current research methods are grounded in the same scientific thinking that grounds the field of educational technology. In a sense, this type of techno-rational thinking is systemic. For Marcuse, techno-rationalism creates one-dimensional thought or a preoccupation with the purely technical. Burbules and Warnick (2006) observed this idea manifested in educational research methods and argued:

> Many in the field of education today neglect (even disparage) critical reflection about educational aims and their grounding in deeper, often unexamined, assumptions about knowledge and value; instead, they seem preoccupied with the exigencies of test scores and other narrow measures of accountability. An era of

> preoccupation with "what works" (i.e., what works in relation to ends that are not themselves open to debate) submerges such critical and reflective questions under a flood of instrumental knowledge. (p. 489)

If we hope to escape the limitations of the current thinking, it stands to reason we would need an alternative tool of critique. It is not to say that the methods I am proposing are not academic or rigorous, rather it is to say that they do not represent the purely scientific methods utilized in much of the current thinking in the field. The need for a different tool, coupled with the fact that I am attempting to weave together several academic areas, has led me to choose dialectical method as a framework or structure for this project.

Utilized primarily by philosophers, this method is based on a dialogue between two or more people who hold different positions and wish to persuade each other. Greene and Caracelli (2003) described the dialectical method in this way:

> To think dialectically is to invite the juxtaposition of opposed or contradictory ideas, to interact with the tensions invoked by these contesting arguments, or to engage in the play of ideas. The arguments and ideas that are engaged in this dialectic stance emanate from the assumptions that constitute philosophical paradigms—assumptions about the social world, social knowledge, and the purpose of science in society. (p. 96)

As a result, the dialectical method allows for explicit engagement in the ideas and points of view around technology. This method was best suited to critically explore the underlying historical and philosophical assumptions around technology.

By using specific arguments as reference points, I was able to engage in a critical conversation between the two views of technology. It is important to point out that this method is recursive, an ongoing reflective process. In reference to dialectical research Smith (2006) noted:

> Validity in dialectical research is an ongoing process rather than a fixed characteristic of a particular study. Validation as a process is never complete, always subject to new information and insights, and always referring to a social world-of moving back and forth among purpose, data, theories, inferences, and audiences. Validation builds on the comprehensiveness, contextuality, and coherence criteria of qualitative research . . . always keeping in mind the assumptions and fallibility of methods. (p. 472)

Given that the chosen thinkers are no longer living, nor did they ever engage in a dialog with each other, it will require additional research techniques to develop the discussion. Therefore, the conversation between Taylor (2011) and Marcuse (1991) was informed by an in-depth content analysis of the two original works outlined above.

It is important to point out that while researchers aim for detachment and objectivity, any research of this type is inherently value-laden. We all approach research from a particular perspective and bring to the task different experiences and assumptions. One would be naïve in believing they could be entirely unbiased or objective. As Lévi-Strauss (1966) argued, even the scientist "never carries on a dialogue with nature pure and simple but rather with a particular relationship between nature and culture definable in terms of his particular period and civilization and the material means at his disposal" (p. 19). Rather than pretend that one does not come to the table with a particular set of biases, one must focus on being clear about their bias and position.

Content analysis is concerned with identifying themes and constructing meaning from a set of data. The specifics of content analysis can vary greatly. Stemler (2001) took a statistical approach and defined content analysis "as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding" (p. 1). This approach involves statistical analysis of text to identify frequency of words and themes. Mckee (2003) offered a more open interpretation of content analysis: "We make an educated guess at some of the most likely interpretations that might be made of that text" (p.1). Given the aim of this project, it was necessary for the method of content analysis to extend beyond a purely statistical summary of the text and instead focus on the underlying assumptions and themes in the text.

As a result, this project focused on the two primary texts mentioned above. One of the key challenges of this project was that neither Marcuse nor Taylor spent significant time speaking directly to the idea of education. Additionally, neither of them spent any time explicitly speaking to technology in education. This posed some complex problems when creating a dialog between their views centered on educational technology. As such, it was necessary to extrapolate their ideas by moving from a technology-in-general perspective to a technology-in-education perspective.

Themes of Analysis

With the goal of comparing and contrasting Taylor's (2011) and Marcuse's (1991) views on educational technology, it was necessary to identify key assumptions and themes in their work. Rozycki (1999) identified several deep philosophical ideas related to education, including the theory of knowledge, theory of human nature, and theory of society. Borrowing partly from Rozycki's (1999) work and philosophers of technology (Feenberg, 1991), the following five themes were used to frame the textual analysis of both Taylor and Marcuse. It was important to understand the connectedness of these areas. In some sense they are artificial distinctions, however, they do serve as a way of making meaning of their work.

Understanding of Truth

Initially this seems an unlikely place to spend any analytical time, but how we construct facts is central to how we frame meaning, arguments, decisions, and policy. Is truth based on reason alone or physical observation and experience? What can we know and how can we know it? As we begin to unpack both Taylor (2011) and Marcuse (1991), we will find that they have vastly different views of truth. These views shape the foundation of their beliefs about how one comes to understand the world.

Conceptions of Human Nature

Are individuals innately irrational, good, absurd, or lazy? Do we have free will? Are we created equal? Are people by nature competitive or cooperative? These questions may seem out of place in a discussion about technology in education, but they play a key roll in understanding the larger issues of autonomy and human motivation. Technology in education is often touted as a motivational tool for learners. If that is the case, then ones views of human nature and how to motivate individuals are important.

Relationship of the Individual to Society

What is the relationship between one person and another? Between individuals and the state? Who has power and who does not? Issues of power were critically important for both Marcuse (1991) and Taylor (2011). Technology in education has the ability to enable or disable the individual in subtle ways. Referred to as the digital divide, technology can serve to give access to some while taking it away from others.

Nature of Technology

This area, as outlined earlier in the chapter, asks is technology value-neutral or value-laden? Does technology drive us in certain ways or are we in control? With this more in-depth engagement with Taylor's (2011) and Marcuse's (1991) views of technology we can effectively apply those views to the field of educational technology.

Aims of Education

What are the purposes of education? Are people blank slates? What forms should education take? Do the authors tend to associate with a particular philosophy of education? As previously mentioned, neither Taylor (2011) nor Marcuse (1991) spent much time speaking specifically about the aims of education even though they often alluded to educational themes. Though the analysis of the previous four themes coupled with an analysis of what Taylor (2011) and Marcuse (1991) did say about education, basic suppositions about were identified for each. These basic assumptions were then compared with various educational movements to identify any foundational congruencies. This form of analysis allowed them to be associated with a particular philosophy of education.

Conclusion

Returning once more to the opening quote, Goodman argued that technology should be considered a branch of moral philosophy, not of science. As I have demonstrated, the ways in which we frame educational technology, assess its effectiveness, and make judgments about its potential, often exclude essential reference points such as the origins of the field, the nature of technology and alternative critical frameworks. I believe it is only by bringing these essential reference points together in conversation that we can begin to make more informed choices about technology in education. With that in mind, this project seeks to do just that in a way that it begins the conversation for practitioners and policymakers alike.

Structure

In summary, this five-chapter dissertation started by identifying the problem, reviewing relevant literature, and defining the methodology. The second chapter will engage specifically with Taylor (2011) as an example of techno-rational thinking. The third chapter will focus on Marcuse (1991) and critical theory. Then, the fourth chapter will apply the same themes of analysis utilized in Chapters II and III to analyze the last four national educational technology plans (NETPs). The fifth chapter will explore the implications of the NETPs by engaging in a didactical analysis of several emerging educational technologies. Chapter V will end by identifying several ways for policymakers and practitioners to engage in more critically oriented perspectives in the field of educational technology.

CHAPTER II

FREDERICK WINSLOW TAYLOR

> The fundamental principles of scientific management are applicable to all kinds of human activities, from our simplest individual acts to the works of our great corporations . . . the same principles can be applied with equal force to all social activities: to the management of our homes; the management of our farms; the management of the business of our tradesman, large and small; of our churches, our philanthropic institutions, our universities and our governmental departments. (Taylor, 2011, p. 9)

Keeping in mind the aim of putting Taylor's (2011) view of technology in tension with Marcuse's (1991) view of technology, this chapter focuses on revealing the underlying assumptions in Taylor's work. Much of Taylor's published work focused on either shop management (1896, 2011) or manufacturing topics such as; reinforced concrete (1916), metal cutting (1927) and machine belting (1894). The chapter focuses on one of Taylor's (2011) most influential texts originally published in 1911, *The Principles of Scientific Management*. As discussed in Chapter I, Taylor was chosen for two reasons. First and foremost his work is representative of techno-rational thought. Second, Taylor's work coincides historically with both the growth of this way of thinking about technology in the field of education and the introduction of early forms educational technology in schools. The roots of this historical crossroads serve as a foundation for current practice in the field of educational technology. His text was analyzed using the five themes identified in Chapter I.

Background

Before delving into the more formal textual analysis, it is important to recognize that Taylor did not come up with his method in a vacuum; his view was a product of his environment and the political culture at the time. After finishing a rather privileged education including an engineering degree from Stevens Institute of Technology, he began working in a local foundry sweeping floors and doing odd jobs around the shop. This was the way most apprenticeships worked at the time. Students fresh out of school had to serve time working on the shop floor in order to receive their informal education. Given his talent working with his hands, coupled with an aptitude for math, Taylor quickly rose to rank of patternmaker. In the metalworking trade the patternmaker would create a wooden mold of an object to be cast out of metal. On a fundamental level, this craft couldn't be easier. The patternmaker created a wooden reproduction of the object to be cast. The reproduction was placed in special sand, an impression was taken of the pattern and then liquid metal was poured into the void left by the pattern. In practice, the work of patternmaker was far more complex. First, when hot metal cooled in shrank at the rate of an eighth of an inch for every foot. Second, the shape of the pattern and the characteristics of the sand presented complex problems for patternmakers. Kanigel described this process well: "even something as absurdly simple as a perfect cylinder or cube could not, in its foundry pattern, be a perfect cylinder or cube" (1997, p. 113). The patternmaker needed to understand the final use of the casting in order to build the appropriate pattern. Kanigel continued, "patternmaking demanded intelligence, skill and creativity" (1997, p. 115).

During his apprenticeship he quickly learned about the art of soldiering, or acting busy when the shop boss came by. Taylor (2011) later reflected on this informal education:

> Hardly a competent workman can be found in a large establishment, who does not devote a considerable part of his time to studying just how slowly he can work and still convince his employer that he is going at a good pace. (p. 33)

For Taylor, a mathematical and rational thinker, this was problematic (Kanigel, 1997).

Taylor is credited with being the father of the scientific management movement. His method took shape at the near the height of the industrial age and focused on making manufacturing more productive and efficient. Taylor employed time studies, direct observation, job specialization, and process standardization (among other methods) to increase worker performance, speed up equipment and lessen downtime, in order to make nearly every process more efficient and productive. While many of Taylor's specific tactics were not new in industrial environments, he created a new systematic form of shop management that encompassed nearly every facet of worker and shop performance (Kanigel, 1997).

In the opening quote, Taylor (2011) argued that these principles could be applied almost universally. Some 21st century historians have argued that he was successful, "Taylor's thinking . . . so permeates the soil of modern life we no longer realize it's there" (Kanigel, 1997, p. 7). Not only did his thinking have an impact in various fields, Taylor's scientific management served as a conceptual reference point for many school leadership and reform movements (Callahan, 1962; Tyack, 1974). In many ways, Taylor was not merely the father of scientific management, but he also normalized a way of thinking about the nature of technology. What was it about Taylor's thinking that could have been so influential that society is no longer aware of its influence? What are the main tenets of his way of thinking? To answer this question one must get to the root of Taylor's views.

Taylor was interested in making people and processes more efficient by taking the guesswork and the laxity out of shop work. He first started with the low hanging fruit: If problems and resolutions could be identified beforehand, the workers could remain on task and stay busy. While hard to imagine given our refined and standardized factories in the western world, there was a time not too long ago when factories were plagued with inconsistencies. Manufacturers struggled with even the simplest things, from where basic tools were kept, to the type and style of fasteners that held together equipment (Kanigel, 1997).

Everywhere Taylor turned he found disorder and laxity. Take for instance a lathe breakdown in the shop. Since fasteners were all turned arbitrarily by different workers with no attention to consistency, fasteners did not match and simple repairs could take days and require fabrication of various parts. This would bring a shop to its knees with potentially dozens of workers *soldiering* or looking busy while repairs were being completed. This was Taylor's reality. He saw waste in nearly every aspect of shop management. As his method evolved, it addressed everything from maintenance schedules to job specialization to establishing pay rates for specific tasks (Kanigel, 1997).

Context of the Written Work

Taylor first published *The Principles of Scientific Management* in 1911, during an era of rapid industrial growth. With this growth came a pressure on many systems, but especially natural resources and labor. Taylor was writing at a time when efficiency was a common topic among various social and political circles. In his introduction, Taylor employed a presidential address by Roosevelt to solidify the urgency and applicability of his method. He quoted, “The conservation of our national resources is only preliminary to the larger questions of national efficiency” (as cited in Taylor, 2011). Systems were experiencing stress as the result of population growth and rapid industrialization. Taylor (2011) argued that while natural resources were certainly an important aspect of the larger equation, human effort was the country’s largest inefficiency. With the political call for national efficiency, along with his direct experience with workers soldiering, it makes sense that he would devise a method to obtain the highest output from the least amount of material and human effort.

The Principles of Scientific Management was originally prepared for presentation to the American Society of Mechanical Engineers. Given this audience, many of Taylor’s illustrations focused on industrial and manufacturing establishments. In his introduction, Taylor identified three primary aims for his paper: (a) to point out inefficiency in almost all of our daily acts, (b) to demonstrate the remedy for this inefficiency lies in systematic management, and (c) to prove that the best management is a true science, resting upon clearly defined laws, rules, and principles, as a foundation (Taylor, 2011).

This chapter is not meant to be merely a summary of Taylor’s work; rather it aims to unpack the underlying assumptions surrounding his method. Returning to the first guiding research question identified in Chapter I, what are the main intellectual assumptions behind Taylor’s ideas? The following analysis will attempt to answer that question while utilizing the five interrelated themes outlined in Chapter I: truth, human nature, relationship to society, nature of technology, and the aim education.

Understanding of Truth

How one constructs facts is central to framing meaning, arguments, decisions and practice. Did Taylor believe truth was based on reason alone or physical observation and experience? Unpacking Taylor's view of truth will expose the foundations not only of his system of shop management, but also how he understood the world.

The first assumption Taylor made about truth was that truth cannot be understood through human judgment alone. As a rule, individuals are incapable or unable to know or describe truth. For Taylor it was a matter of objectivity, as human nature prevents us from seeing the world properly. He described what commonly passes for truth as merely rule-of-thumb thinking. This rule-of-thumb thinking is plagued with laxity and guesswork. In chapter one of his text, Taylor described the root of the problem: "The inefficient rule-of-thumb methods, which are still almost universal in all trades, and in practicing which our workmen waste a large part of their effort" (2011, p. 15). As Taylor witnessed in many shops, flawed rule-of-thumb thinking was the primary means for determining the best way to complete a task. Taylor's argument seems reasonable given his background. As he learned more about shop management, he found that each person in the process had their own idiosyncratic method for completing tasks. Often these workmen argued their methods were superior based on years of experience and would refuse to change their practice.

Second, Taylor felt that to get beyond rule-of-thumb thinking a structured and systematic method needed to be applied to shop management. As a result, Taylor began applying scientific study and experimentation to shop management. Taylor argued:

> The development of a science . . . involves the establishment of many rules, laws, and formulae which replace the judgment of the individual workmen and which can be effectively used only after having been systematically recorded, indexed, etc. (2011, p. 31)

To be clear about his view, Taylor believed that science was the only means of disclosing facts. Moreover, science should replace the judgment of individuals. Given how Taylor's method took shape, analyzing the failure rate of various metals used for shaping parts, this line of thinking makes sense given the guesswork that guided current thinking in shops at the time. Over the course of his tenure, Taylor conducted thousands of experiments to determine the best combination of metals, sharpness and speed for turning different pieces of equipment. His early experiments proved effective. For instance in one series of experiments he utilized a stream of water on the cutting bit of the lathe. The result was the speed of the lathe could be increased by 40 percent with no adverse effects (Kanigel, 1997, p. 179). The faster the lathe could cut, the more material could be removed from a part in a shorter amount of time resulting increase productivity and efficiency.

As his method continued to evolve, Taylor began extending his scope to establish repair kits for common equipment failures and placed equipment on maintenance schedules to prevent failures all together. By keeping detailed records that tracked how long it took a drive belt to fail, workmen could replace them just prior to failure in order to prevent costly downtime. Rather than relying on guesswork, Taylor could accurately determine various aspects of the process. These facts could then produce “clearly defined laws, rules, and principles” that could be applied to various aspects of shop management (Taylor, 2011, p. 8).

Third, the principles of scientific management were extended to various human endeavors within the shop. Taylor and his disciples would study every aspect of the process, moving beyond how fast the lathe turned to how much time a craftsman took wandering about the shop trying to find the right tool or waiting for a needed component. Again and again, Taylor applied science to shop management, often relying on a stopwatch and detailed notes to track nearly every aspect of a specific job. From these extensive studies, he then developed detailed charts and tables that prescribed how long a job should take and how much it should cost. For instance, at Bethlehem Steel Works, Taylor dramatically increased worker production and wages by matching the shovel with the type of material that was being moved. This resulted in a decrease in the total number of workers needed to shovel coal from 500 to 140 (Taylor, 2011).

As his method developed, Taylor enlisted more experts to study and detail nearly every aspect of the work to be done, all with an eye toward the one best way of completing the task. New management offices and legions of managers were prescribing everything from how many people were needed at any given time to when workers should take breaks. As a result, the need for skilled shop labor began to diminish and shop standardization took hold.

What is important to recognize is that Taylor insisted his method should apply to every aspect of the process including the more human aspects. Taylor argued: “One of the most important objects of this paper is to convince its reader that every single act of every workman can be reduced to science" (2011, p. 50). Taylor began connecting his work to other disciplines including human physiology. At the time, physiologists were designing experiments to determine a person's "personal coefficient" (Taylor, 2011, p. 68). Taylor believed that this type of work—along with his shop management—could revolutionize everything we do. Taylor argued that "facts are in many ways more convincing than opinions or theories" (2011, p. 104). Rationally speaking, it was impossible to argue with Taylor's method because it was a matter of science, it was objective, it was fact.

This type of thinking is ubiquitous in modern times. While the language has changed slightly to reflect the increased utilization of computer technology and statistical analysis, the thinking is grounded on the same premise as it was in Taylor's era. The stop watch has been replaced with modern computer technology and as a result there is an ever increasing set of data points from which to glean factual information. Terms like business processes, data-driven decisions, data mining, and analytics are commonplace. These vast sets of data generated by computerization can be analyzed and used for predictive modeling. Decisions about everything from how much one should pay for a rental car, given specific market conditions, to how much milk should kept on hand in the grocery store is driven by vast amounts of raw data.

To reiterate, Taylor (2011) believed that human judgment and rule-of-thumb thinking was flawed. Science is the only way to properly understand the world because science disclosed facts. These facts could then be used to develop laws, rules, and principles. In other words, only through objective, measured observation can truth be established.

Concepts of Human Nature

Did Taylor believe that individuals are innately irrational, good, or lazy? Do individuals have free will? Are we created equal? Are people by nature competitive or cooperative? As discussed in the introduction to this chapter, Taylor was originally motived to bring order to shop management. He cited his informal education in the art of soldiering as a primary motivator for his life's work. This fact is telling with regard to his views on human nature.

At best, Taylor described our daily acts as blundering, ill-directed, and inefficient (2011, p. 7). This waste of human effort, as he described it, was one of the key areas for necessary improvement if we were to increase national efficiency. Taylor believed that individuals are lazy by nature and "the natural laziness of men is serious" (2011, p. 18). He found this idea of laziness manifest in the shop as soldiering or the mindset of individual workman planning "to do as little as he safely can" (Taylor, 2011, p. 13). Taylor described the problem of soldiering to be nearly ubiquitous. He stated:

> So universal is soldiering for this purpose that hardly a competent workman can be found in a large establishment . . . who does not devote a considerable part of his time to studying just how slow he can work and still convince his employer that he is going at a good pace. (2011, p. 19)

Taylor saw the problem of soldiering having two distinct facets. The first was what he called natural soldiering. Natural soldiering is based on one's natural instinct to take it easy. The second was learned soldiering or systematic soldiering. This type of soldiering is more complex and based on one's social relationship with other workers. Taylor felt that as more men were brought together to complete a task, this resulted in even higher degrees of systematic soldiering, in part because there were more people that needed to look busy. As a result, it was in the group's best interest to ensure that each person had his or her role in the scheme. Regardless, Taylor believed that all men spend a great deal time and effort "loafing" (2011, p. 17). His mission was to mitigate this aspect of human nature through systematic control.

What was Taylor's view of an individual's agency? For Taylor, individuals were fixed by their education and position in life. Rather than being free agents able to choose a course of action from among various alternatives, Taylor believed they were predetermined. He often referred to individuals as being incapable or having insufficient mental capacity for understanding difficult concepts and making choices. Additionally, he often defined men by their class, as if it were a known and fixed quantity. Taylor felt individuals are primarily guided by their disposition, unable to operate freely. For example, Taylor wanted to identify each man's "personal coefficient" in order to place him in the most appropriate role (2011, p. 68). Extending Taylor's position, one could argue that given enough scientific study, one could determine a man's fate based on various calculations.

Finally, given Taylor's position on man's natural tendency for loafing, it was reasonable to assert that men are not naturally competitive nor are they cooperative; rather, individuals need constant guidance and coaching to complete tasks. This was clearly evident in how prescriptive each and every task was for workers in the shop. Taylor even extended his scientific management to studying the motivation of men.

Taylor recognized that this jump from material management to people management might seem misplaced; however, he argued:

> At first it may appear that this is a matter for individual observation and judgment, and is not a proper subject for exact scientific experiments. It is true that the laws which result from experiments of this class, owing to the fact that the very complex organism—the human being—is being experimented with, are subject to a larger number of exceptions than is the case with laws relating to material things. And yet laws of this kind, which apply to a large majority of men, unquestionably exist. (2011, p. 90)

In other words, Taylor believed that determining the motivations of individuals was best left to scientific study rather than one's individual judgment.

To summarize, Taylor was relatively transparent in his view of human nature. For him, the overwhelming majority of people were naturally lazy. This laziness was then reinforced by learned soldiering. In addition, one's physical and mental capabilities were relatively fixed, more or less a product of their upbringing and environment. This combination of factors determined one's class and position in life. Furthermore, Taylor felt that human motivations could be studied scientifically and individuals could be measured and evaluated to determine their worth as a component of production.

Relationship of the Individual to Society

What is the relationship between one person and another? Between individuals and the state? Who has power and who does not? Issues of power were more nuanced for Taylor. As outlined above, Taylor (2011) believed that individuals had little power over their choices in life; as a result they needed an advocate, someone to speak up for the working-class men in the factories and create better working conditions, better wages, and better relationships with managers.

Taylor argued his method would raise the standard of living of workers and stoke the fires of capitalism. In many ways his vision was realized. With the combination of cheaper goods and workers getting paid more for an honest (calculated) day's labor, Taylor contributed to raising the bar. In fact, one scholar argued that "Taylor viewed himself as the workingman's dearest friend, as the Great Harmonizer intent on doing good for workers, capitalist, and public alike" (Kanigel, 1997, p. 17). Taylor believed that his system would create a better, more efficient, and productive world. He believed his system of scientific management was at the heart of a new and wonderful era. Taylor said that "in the past the man has been first; in the future the system must be first. . . . The first object of any good system must be that of developing first class men" (Taylor, 2011, p. 8). This raising of the bar would be accomplished in several ways: first by improving relations between workers and managers, second by focusing on issues of training and organization in the shop, and third by paying workers slightly more for what he and his disciples determined an to be an honest day's work.

To achieve an honest days work, workers were selected and trained with the aim of developing first class men. In many cases, these men were vetted to make sure they well suited for the task and able to complete tasks accurately and efficiently. Once teams or gangs of workers were selected, the focus shifted to the relationship between the workers and their direct supervisors. He accomplished this by bringing the supervisors out of their offices and to the shop floor to watch and study their workmen. The aim was to provide direct quantifiable feedback aimed at identifying more productive and efficient ways to complete tasks. Taylor felt this created a more friendly and collaborative dynamic between the workers and managers.

One other aspect of his method was to isolate workers from each other for the majority of the day. They no longer had an opportunity to systematically soldier with others on the shop floor. Each and every action of a worker's time was accounted for as part of Taylor's method. If a worker performed up to expectation and completed the task as outlined by management, he stood to earn more than before and raise his standard of living. In this way, Taylor could produce legions of first class men that would become the cogs in a growing world of modern machinery and capitalism.

How did these changes in shop management affect the power dynamics? Taylor spent time in his text acknowledging that workers felt all this structure and accountability made them, "a mere automation, a wooden man" (2011, p. 94). He went on to make a comparison to surgeons, architects, and doctors. Taylor argued that these professions were highly regarded, yet much of their work was intensely prescriptive. Factory work should be viewed in the same light.

It is hard to argue his method did not take power and autonomy away from workers. The workmen, many with years of experience, were often retrained. His method focused on dictating each and every action often well in advance of the workday. Taylor even described the process of the clerks orchestrating the actions of the workers as "chessmen are moved on a chessboard" (2011, p. 53). Taylor took advantage of a telephone and messenger system to ensure that everyone knew his or her place and stayed on task. He also argued for management to "take over all work for which they are better fitted than the workmen" (Taylor, 2011, p. 31). Ironically, this chess analogy sounded as if the workers were merely pawns. According to Taylor, workers had two options: they could either focus on their job and complete an honest day's work, or they could shift to a more suitable class of work.

The labor efficiencies gained on the shop floor had other hidden costs with respect to an individual's sense of power and autonomy. Taylor's system succeeded in formalizing much larger bureaucratic systems than had previously existed prior to his form of shop management. The labor gains his method realized on the shop floor shifted the labor from material handling to management. Many shops had to build new offices and hire a previously unknown class of educated men trained in scientific management. The sole purpose of this new class of worker was to implement the rules, laws, and functions established by careful study. In some respects this new class of worker was subsidized by the increased labor of those on the shop floors.

Unfortunately, there is disconnect between his stated theory and practice. On the one hand, Taylor argued he was advocating for all and assumed the side of both labor and management. He stated that "the principle object of management should be to secure the maximum prosperity for the employer, coupled with the maximum prosperity for each employee" (Taylor, 2011, p. 10). Additionally, Taylor discussed improving relationships between employees and employers and described that relationship as intimate and cooperative (2011, p. 13). Yet, in practice, his method isolated workers, simplified their craft, and dictated their daily actions while creating an unprecedented level of bureaucratic power over the shop.

In numerous instances, factory workers went on strike where Taylor's method was instituted in their shops. Word often traveled quickly among labor groups and some workers even walked off the job at the sight of stopwatch. In 1911 at Watertown Arsenal, located on the Charles River in Watertown, Massachusetts, one worker was fired for not allowing the efficiency experts to document his work. In a letter of petition to Colonel Wheeler, they detailed their objections to scientific management and described it as "un-American in principle" and "humiliating," (as cited in Kanigel, 1997, p. 476).

The newspaper headlines were not kind to Taylor and his method either. One headline read, "MOLDERS QUIT AT WATERTOWN: Arsenal Men Balk at 'Spy' System". Taylor responded to the press that his method had been instituted incorrectly by one of his associates and without proper explanation to the workers. The time studies had been instituted prematurely. If the system had been followed correctly there would be no room for argument or disagreement. In other words, you can't argue with science. Unfortunately, this was only the beginning of trouble for Taylor and his method (Kanigel, 1997).

It was not long before the federal government got involved. In August of 1911, the U.S. House passed Resolution 90, authorizing a special committee to investigate Taylor and other systems of shop management. By 1912, Taylor was called to testify before the special committee and answer to the claims made by various labor groups about his system. Many of the objections revolved around issues of his method being inhumane, unreasonable, and humiliating, all of which resulted in deskilling workers, destroying morale, and draining the life from workers (Kanigel, 1997).

During his testimony, Taylor did not deviate from the tenants of the techno-rational worldview. Technology was a sign of progress. Technology and his method had nothing against anyone; it was neutral. He went as far as to say that his system was just.

He stated Taylorism "ceases to exist when injustice knowingly exists. Injustice is typical of some other management, not of scientific management," (Taylor as cited in Kanigel, 1997, p. 476). Taylor felt that people were uninformed and just did not understand the tenants of his method. If they did, they would have no legitimist objections. How could they? He was dealing with science, not guesswork. Moreover, Taylor truly believed in what he was doing and felt that science brought legitimacy to his craft, regardless if it was applied to machines or people. Taylor also stayed the course with regard to his method bringing prosperity and luxuries to the masses, and that while working class jobs were lost, more management jobs were created (Kanigel, 1997).

Nature of Technology

What was Taylor's view as it related to the nature of technology? Is technology value neutral or value laden? Does technology drive us in certain ways or are we in control? First, it should be made clear that Taylor would never have thought in these terms about the nature of technology. The idea that technology could have values or that it drives us in certain ways would seem foreign to him and his contemporaries. Since Taylor never discussed technology in these terms, it is necessary to draw his view from his writings.

At the core, Taylor believed that technology is neutral. Technology was something created by man to be used, studied, and harnessed. Technology was employed at the will of the user; any particular use of technology was best decided by scientific study. Therefore, specific technologies were morally neutral and it was a matter of science that determined the value and proper purpose for any given tool. This makes good sense given Taylor's context and his views of truth. While views to the contrary did exist at the time, they were by no means widespread and as a result this assumption of the neutrality of technology, would not have been challenged. In fact, the vast majority of people would have ardently agreed with his view given its common sense quality. When Taylor's view is positioned on one plane of Feenberg's (1991) model outlined in Chapter I, it is value neutral.

Second, Taylor believed that technology evolved over time; not merely changed over time but rather the change was a sign of progress. As one technology was adopted or implemented, it was refined and made substantively better through objective scientific examination. With each new technology, problems could be isolated and machines and practices modified. New technologies made goods cheaper, reduced laxity, and made work easier and more convenient; ultimately this would result in a better world. Taylor argued that these gains could be achieved "whether it be the invention of a new machine or the introduction of a better method" (2011, p. 15). Taylor truly believed that this twofold approach of technique and technology placed a new world order within reach. By replacing the rule-of-thumb thinking that had dominated pre-modern times with science and technology, the modern world would evolve more rapidly into a more civilized and prosperous place.

Closely associated with the notion of technological evolution was the idea of the technological imperative. This principle stated that because a particular technology gives one the capacity to do something, meaning it is technically possible, then this something either ought to, must, or inevitably will become a technological reality (Ozbekan, 1968). Taylor felt that his method was essential to move society forward. He argued that "it is only through *enforced* [emphasis added] standardization of methods, *enforced* [emphasis added] adoption of the best implements and working conditions, and *enforced* [emphasis added] cooperation that this faster work can be assured" (Taylor, 2011, p. 62). This work of enforcing his method was left to the managers because they were the ones that were properly educated in his method and could properly see the role of technology as a means of ushering in a better world. In this regard, Taylor's view would best be thought of as deterministic, in other words, technology has a specific trajectory. Properly placed in Feenberg's (1991) framework, Taylor would be considered a neutral-determinist. It is at this position that one believes that technology is morally neutral and yet has a natural progression over time.

Aims of Education

What are the purposes of education? Are people blank slates? What forms should education take? Does Taylor's thinking tend to associate with a particular philosophy of education? While he did not explicitly discuss education and educational methods with any depth, Taylor clearly had a vision for scientific management in education. Returning to the opening quote for this chapter, Taylor stated:

> The same principles can be applied with equal force to all social activities: to the management of our homes; the management of our farms; the management of the business of our tradesman, large and small; of our churches, our philanthropic institutions, our universities and our governmental departments. (2011, p. 9)

As Taylor saw it, his method is universally applicable, even to teaching and learning.

As previously discussed, Taylor felt an individual's ability could be quantified—a personal coefficient. This ability could be measured and compared to others. Nowhere in his text did he discuss a person's ability to learn or grow beyond their natural ability.

His method sought to find the highest-grade work for a person's "natural ability" (Taylor, 2011, p. 10). This would have been a commonsense view in many circles at the time. This notion of a fixed intellect permeated his thinking about shop management and would likely have permeated his thinking about learning in schools. This type of thinking was reflected in academic tracking of students based on high stakes testing. Given a well-designed assessment, the thinking follows that one could pre-determine a child's success given any particular academic track.

One issue that Taylor took up in his life's work was to change the methods utilized in shops to train workers. Traditional training was completed using an apprenticeship model with the older, more experienced workers training the younger inexperienced workers. Taylor felt this was problematic for two reasons. First, he felt there was a clear conflict of interest with regard to how well the younger workers were trained. Taylor's thinking followed that if the newly trained workers could do the work more quickly and efficiently than their older mentors, there would be trouble. The older workers needed to ensure that things stayed as they were in order to keep their jobs and not be replaced with the younger and faster workers. As a result, Taylor felt too much time was spent trying to muddy the process of training younger workers so the older workers would stay employed. Second, the method of having the inexperienced workers trained by their elders relied on imperfect lessons based on rule-of-thumb thinking. These lessons often involved a watch and learn format. Taylor argued that while these methods advanced over time to reflect lessons learned, "practically in no instances have they been codified or systematically analyzed or described" (2011, p. 27). Therefore, Taylor believed that knowledge passed along from generation to generation was fundamentally flawed; the product of imperfect knowledge and systemic soldiering. This was especially the case in the context of the shop and merely resulted in perpetuating bad practice and multiple ways of completing the same task. Simply stated, current instructional methods in the shop were outdated and unscientific. Arguably, this line of thinking would also apply to the classroom. Teachers would take center stage in student learning.

Taylor felt instruction could only be done properly by experts. In Taylor's words, workmen must be "trained by a man more intelligent than himself into the habits of working in accordance with the laws of this science before he can be successful" (2011, p. 47). These experts were shop managers that were properly educated in Taylor's method and who had directly studied the task they hoped to teach the workmen. Additionally, these experts would systematically record daily statistics and develop rules, laws, and formulas to replace current practice and ensure that the workers were indeed following the new rules. This process would begin with elaborate scientific study of the current processes. Only then could managers devise proper instructional techniques. Once the one best way had been devised, managers could "scientifically select and then train, teach and develop the workman" (Taylor, 2011, p. 30).

This type of thinking is also reflected in current practices in schools. Teachers are taught how to deliver packaged content designed by experts. These curriculum experts have designed structured lessons that assess students before, during, and after each instructional unit to ensure that learning is occurring efficiently. Moreover, teachers and schools are being assessed on the student's ability to reach clearly defined benchmarks.

In terms of associating Taylor with a specific educational philosophy, he would have been most closely aligned with behaviorism. Behaviorism has its origins in the early 1900s with the work of the Russian psychologist Pavlov and the American psychologist Watson. Taylor and behaviorism share several important foundational views.

First, behaviorism focuses on the fact that “the only reality is the physical world that we discern through careful, scientific observation” (Nayak & Rao, 2004, p. 17). This belief is clearly reflected in Taylor’s view of truth. Second, behaviorism is grounded on the belief that there is no free will that individuals are shaped by their environment and experiences. This coincides with Taylor’s view of human nature. Taylor argued that if managers provided the proper incentives whenever a workman (or student) performed a desired task, they would learn to complete the task more accurately and efficiently. Third, in practical terms, behaviorists isolate instructional tasks into small, manageable, and measurable units. This allows students to build from one simple task to more complex tasks. This also coincides with Taylor’s view. He stated that:

> No efficient teacher would think of giving a class of students an indefinite lesson to learn. Each day a definite, clear-cut task is set by the teacher before each scholar, stating that he must learn just so much of the subject; and it is only by this means that proper, systematic progress can be made by the students. (Taylor, 2011, p. 91)

In practice, Taylor’s view had a substantive impact on schools in America. As early as 1911, scientific management formally found its way into education. Prior to this time, schools often took the form of one-room schoolhouses, which were governed by the local community. In his book, *The One Best System: A History of American Urban Education*, Tyack (1974) explained that school administrators were "convinced that there was one best system of education for urban populations. . . . They were impressed with the order and efficiency of the new technology and forms of organization they saw about them" (p. 28). Here the technology is the principles of scientific management. At the height of Taylor's career, several universities contacted Taylor, wanting him to lead their institutions. Evidence suggests that Taylor was even courted by the Massachusetts Institute of Technology in 1907, an offer which he declined (Kanigel, 1997). With several institutions of higher education captivated with Taylor and his method, it was not long before public schools followed suit.

By the turn of the twentieth century, leadership in American public schools had shifted from part-time educational evangelists to professional managers that made school management a lifetime career (Tyack, 1974). One of the most influential texts of the time on the subject of school management was written by Ellwood P. Cubberley. His book entitled *Public School Administration, A Statement of the Fundamental Principles Underlying the Organization and Administration of Public Education* served as both a historical analysis of public school administration and as a call for change. Tyack and Hansot (1982) argued that "Cubberley was one of a small band of leaders who professionalized school administration" (p. 121). Much like Taylor, Cubberley saw school management plagued with inefficiencies and guesswork. In other words, it was unscientific. School districts were often organized in radically different ways and with widely diverse outcomes. Cubberley aimed to bring order and science into the realm of school management given the increased demands of public schools and growing student populations (Tyack, 1974).

The considerable impact of scientific management was explicit in Cubberly's text. In reference to the movement sweeping around the world, he argued that "the significance of this movement is large, for it means nothing less than the ultimate changing of school administration from guesswork to scientific accuracy" (Cubberley, 1922, p. 325). The scientific accuracy that Cubberley talked about was a direct reflection of what scientific management had done for factories. More interestingly, this explicit connection to production shaped the way he framed many of the problems facing effective school management. Cubberley stated that "every manufacturing establishment that turns out a standard product or series of products of any kind maintains a force of efficiency experts to study methods of procedure and to measure and test the output of its works" (1922, p. 338). He was advocating for standardized curriculum and frequent assessments to measure nearly every aspect of schooling. Furthermore, this connection to scientific management shaped how Cubberley understood pupils: "Our schools are, in a sense, factories in which the raw products (children) are to be shaped and fashioned into products to meet the various demands of life" (Cubberley, 1922, p. 338).

In purely philosophical terms, Taylor would be categorized as a positivist. Positivists believe that sensory experiences measured through scientific means is the exclusive source of all worthwhile information. Collins and O'Brien (2003) argued that positivism in educational organizations "reinforces the notion of education being run as machine or in assembly line fashion. Positivism is characterized by top-down management; linear, sequential curriculum; strict time schedules; and departmentalization" (p. 360). The parallels are unambiguous; Taylor's way of thinking was clearly reflected in many dominant educational practices. Standardized curriculum designed by experts, frequent standardized assessment of students, and increasing bureaucratic educational systems are all prominent features of the educational landscape in American education today.

Conclusion

The aim of this chapter was to unpack Taylor's beliefs around five key domains: truth, human nature, relationship to society, nature of technology, and the aim of education. As discussed, Taylor's views are representative of a particular way of thinking about technology that coincides historically with both the growth of instrumentalism in the field of education and the introduction of early forms of modern educational technology in schools. Positioning his view on several theoretical planes, that of philosophy, educational philosophy, and philosophy of technology, gives means, language, and context to discuss the differences between his view and the views of Marcuse. Chapter IV will compare and contrast Taylor and Marcuse utilizing these discussion points.

CHAPTER III

HERBERT MARCUSE

> Observation and experiment, the methodical organization and coordination of data, propositions, and conclusions never proceed in an unstructured, neutral, theoretical space. The project of cognition involves operations on objects, or abstractions from objects which occur in a given universe of discourse and action. Science observes, calculates, and theorizes from a position in this universe. (Marcuse, 1991, p. 157)

Keeping in mind the aim of putting Taylor's view of technology in tension with Marcuse's view of technology, this chapter will focus on revealing the underlying assumptions in Marcuse's work. With this aim in mind, the focus will be on one of Marcuse's published texts, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society* (1991), first published in 1964. As discussed in Chapter I, Marcuse was chosen primarily for two reasons. First and foremost, his work is representative of a particular way of thinking about technology that is well positioned to critique Taylor's view. Second, Marcuse's work coincides historically with the growth of this alternative view of technology and the introduction of more modern forms of educational technology in schools. This historical crossroads serves as a grounding point for critiquing current practice in the field of educational technology. Marcuse's text will be analyzed around the same five themes identified in Chapter I: truth, human nature, relationship to society, nature of technology, and the aim education.

Background

If Taylor is the father of scientific management, Marcuse is the father of the new left. Born in Berlin, he was a German philosopher who studied under Martin Heidegger in the late 1920s. After being exiled from Germany during World War II, Marcuse helped found the Frankfurt School. The Frankfurt School was a collection of academics and philosophers who shared neo-Marxist beliefs. Their aim was to draw on various schools of thought to help fill the voids left by classical Marxist theory. Members of the Frankfurt School, Marcuse included, collectively defined critical social theory or critical theory, as it later became known. This theory was aimed at both responding to a growing capitalist world by means of a neo-Marxist critique and reframing social action. This double-edged sword of both critique and action is considered the foundation for a number of other critical social theories including feminism, critical race theory, and critical pedagogy.

Shortly after being exiled, Marcuse immigrated to the United States. In the 1950s he began teaching at Columbia University and then Harvard University. Much of Marcuse's published work was written over the course of five decades. He was a prolific writer and published numerous books and essays detailing his views about Marxism (1958, 1978), critical theory (1968), and the intersection of technology, capitalism, and social control (1968, 1969, 1972). This chapter focuses on one of Marcuses's (1991) most influential texts originally published in 1968, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society*. He drew on the philosophical views of Marx, Hegel, and Heidegger to help frame his understanding of the interconnectedness of various social and technical realms.

Context of the Written Work

Marcuse published *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society* in 1964, during a time of what Kellner (1984) referred to as stifling conformity and social control. The text was originally written in the 1950s and 1960s as a formal critique and call to action. In many ways, this work was a culmination of a number of different topics and ideas Marcuse had taken up in various essays and lectures. He continued to write long after he finished *One-Dimensional Man,* to further his ideas but also in response to his critics. While some of the details of his philosophy matured after *One-Dimensional Man* was published, the core of Marcuse's work remains intact and relevant to the discussion.

Returning to the opening quote, Marcuse argued that science is not neutral; rather it comes from a specific universe of discourse and action. Marcuse saw this scientific universe of discourse and action colonizing everyday life. This colonization resulted in a loss of individual freedoms and occurred stealthily by imposing technological imperatives, formulas, rules, and instructions on thought and behavior (Marcuse, 1991). Certainly this was the intended outcome in factories under scientific management. Taylor (2011) sought to relieve the workers of guesswork and laxity. Workers were given cards that detailed every aspect of the work to be done. Marcuse (1991) argued this type of thinking robbed them of any freedoms they had in their profession. This issue of control was deeply problematic for Marcuse: The problem was not that workers should not put in a full day's work; rather, the problem was the controlling effect that the method and the technology had on individuals. Marcuse also recognized that the problem extended far beyond the workplace into nearly every aspect of an individual's thought world.

Marcuse felt the development of a modern industrial society and the prevalence of one-dimensional thinking undermined the basis of individual rationality. Through technology, individuals are required to assimilate into the economic, technical, and social systems. He argued that the mechanics of conformity spread throughout society and overwhelmed the individual. No longer were they able perceive their disposition in either public or private life, let alone begin critique the system as a whole. Individual thought was replaced by systematic patterns of thought. These patterns of thought existed both in the workplace and the private space and in many ways they were inescapable and totalitarian.

On the one hand, both Taylor (2011) and Marcuse (1991) articulated their respective views as calls to action, with Taylor critiquing the laxity and disorder that plagued the country, and Marcuse critiquing the technological rationality that dominates modern society. On the other hand, Marcuse had the benefit of hindsight seeing Taylor's view being applied to everything from factories, to homemaking, to genocide. It is important to note that Marcuse wrote *One-Dimensional Man* as a critical response to Taylor's way of thinking and the underlying assumption that grounded it. As a result, the two works are best thought of along a timeline, rather than as works to be assessed and evaluated in parallel. In addition, during modern times, many areas of society have been operating under the influence of positivist, behavioral thought. Understanding Marcuse takes a level of abstraction and a mindful departure from the thought patterns that have been propagated over the last century. As a result, the following analysis of Marcuse's work will require particular care in terms of understanding his view. It would be premature at this point to put Taylor and Marcuse into conversation with each other without having fully unpacked Marcuse's views. The conversation between Taylor and Marcuse will begin in earnest in Chapter IV.

Understanding of Truth

How one constructs facts is central to framing meaning, arguments, decisions, and practice. Did Marcuse believe truth was based on reason alone or physical observation and experience? Unpacking Marcuse's view of truth will expose the foundations not only of his critical theory, but also how he understood the world.

One of the central issues for Marcuse was the role that language plays in our ability to comprehend truth. He argued that language ultimately shapes our ability to perceive and understand the world. The problem is that in modern times it has become normal to speak in terms of facts and figures. When one uses reductionist language to describe events in terms of facts and figures, it eradicates the ability reframe the event with logical alternatives. In a sense, the facts speak for themselves. When this occurs, the language is limiting and fixed. Marcuse argued that "where these reduced concepts govern the analysis of the human reality, individual or social, mental or material, they arrive at a false concreteness- a concreteness isolated from the conditions which constitute its reality" (1991, p. 106).

An example of this type of thinking is reflected in the language used by technology leaders to make decisions about adopting educational technology in schools. Several terms echo the techno-rational thinking outlined in chapter two. Take return on investment (ROI) as an example. ROI refers to the cost benefits resulting from adopting a particular technical system in schools. How will the institution benefit, in financial terms, from a new technology? Another term used by school technologists is total cost of ownership (TCO). The purpose of a TCO assessment is to understand all of the associated costs for a particular technology. How much will a new technology cost an institution? Finally, the term value of investment (VOI) analyses brings the two terms together and explores the anticipated costs and benefits of any given technology project.

The prevalence of this type of language is widespread. This is evidenced by various national organizations and associates that guide educational technology leaders to think in these terms. Take the Consortium for School Networking (CoSN) as an example. Founded in 1992, CoSN is a national professional association for school district technology leaders (CoSN, 2012a). CoSN certifies school technology leaders and their ability to accurately perform ROI, TCO, and VOI assessments in schools (CoSN, 2012b). When school leaders discuss the benefits and cost of implementing any new technologies the conversation will certainly include data and facts from these assessments.

Simply stated, the decision is often a mathematical calculation. The numbers tell technology leaders in schools if a particular technology is a good decision or worthwhile. Moreover, all three assessments revolve around the productivity and efficiency of the technology. This type of thinking is striking similar to the work of Cubberley (1922). Cubberley's aim was to certify educational leaders to think in terms of productivity and efficiency and base decisions on facts and figures directly tied to various educational tools and methods. This concreteness of language, which has resulted from how we have reduced concepts to facts and figures, limits our ability to understand and construct meaning from experiences. Marcuse (1991) would argue that the truth extends beyond the numbers.

Second is the importance of historical context for constructing meaning. For Marcuse, all facts come from a given universe of discourse and action. As such, in order to properly frame and create meaning one must understand various aspects of reality in parallel. Marcuse (1991) argued that this only occurs when one utilizes what he termed multi-dimensional language. When one combines the limited nature of concrete language, as outlined above, and a disregard for the historical context of events, it limits the ability to properly construct meaning. This collapsing of multi-dimensional language is occurring with greater frequency and Marcuse argued that "multi-dimensional language is made into one-dimensional language, in which different and conflicting meanings no longer interpenetrate but are kept apart; the explosive historical dimension of meaning is silenced" (1991, p. 198).

As discussed in Chapter I, this has regularly occurred with regard to how instructional technologists describe the history of the field. Much of the history of the field revolves around dates and the facts surround incremental changes to devices and methods for teaching. All of which is at the exclusion of the more nuanced issues and assumptions being made by policy makers and practitioners. For instance, were educational technologies being integrated as a response to specific political or social concern at the time such as a World War II or the space race? Clearly the historical dimension was important for Marcuse in terms of creating meaning. In order for ideas and concepts to be properly understood it must be framed in relationship to its historical context.

Another important aspect of truth seeking for Marcuse was dialectical analysis. Simply stated, dialectical method is a dialogue between two or more views that aims at revealing truth through reasoned argument, not simply stating facts and figures or merely attempting to convince another of a specific point of view. Dialectical method is focused on discovering truth through reason and logic. Marcuse stated that "the rational society subverts the idea of Reason" (1991, p. 167). For Marcuse, reason was necessary for extending the dialog beyond simple numbers or historical facts. Truth is a matter of constant tension and interpretation. Marcuse summarized his position well when he said:

> If the linguistic behavior blocks conceptual development, if it militates against abstraction and mediation, if it surrenders to the immediate facts, it repels recognition of the factors behind the facts, and thus repels recognition of the facts, and of their historical content. In and for the society, this organization of functional discourse is of vital importance; it serves as a vehicle of coordination and subordination. The unified, functional language is an irreconcilably anti-critical and anti-dialectical language. In it, operational and behavioral rationality absorbs the transcendent, negative, oppositional elements of Reason. (1991, p. 97)

At the core, Marcuse believed truth was a cognitive process achieved through dialectical analysis utilizing reason and logic. It can include—but also extends beyond direct observation—facts and figures. In addition, one's ability to work toward truth can be compromised by the limits of language. These limits often come in the form of reductionist language that can appear fixed or concrete, thus limiting the ability to challenge or put forward reasonable alternatives.

Concepts of Human Nature

Did Marcuse believe that individuals were innately irrational, good, or lazy? Do individuals have free will? Are we created equal? Are people by nature competitive or cooperative? While Marcuse did not spend significant time discussing each of these with any specificity, he did reveal his position with an overarching theme of how individuals are manipulated under a repressive technological society.

Marcuse argued that individuals have an essence that extends beyond simple observable behavior. In other words, individuals are more than simply a sum of their behaviors or actions:

> If I speak of the mind of a person, I do not merely refer to his mental processes as they are revealed in his expression, speech, behavior, etc., nor merely of his dispositions or faculties as experienced or inferred from experience. I also mean that which he does not express, for which he shows no disposition, but which is present nevertheless, and which determines, to a considerable extent, his behavior, his understanding, the formation and range of his concepts. (Marcuse, 1991, p. 209)

Marcuse argued that there is an essence, a soul. He stated that "the soul contains few secrets and longings which cannot be discussed, analyzed, and polled. Solitude, the very condition which sustained the individual against and beyond his society, has become technically impossible" (Marcuse, 1991, p. 71). As a result, individuals are often unable to reach or connect with that soul without the shadow of society.

This disconnectedness from one's essence is brought about by the persistent messaging of various technical, economic, and social forces. These forces are directly correlated with an increasing technical and reductionist way of thinking. In a sense, an individual's needs and desires are shaped and distorted by a repressive society, no longer able to get in touch with one's true nature and true desires. Marcuse stated: "Thus 'negatively present' are the specific 'environmental' forces which precondition his mind for the spontaneous repulsion of certain data, conditions, relations. They are present as repelled material" (1991, p. 209). The messages that bombard an individual precondition him or her to think and behave in certain ways. The messages tell an individual whether or not to like or enjoy certain activities or ideas. More importantly, the messages repress any authentic desires that originate from the soul.

Whether or not individuals are cooperative or competitive, lazy, or simple minded, are merely false dichotomies placed on individuals by modern society. What was most important for Marcuse was recognizing that individuals are constantly manipulated with false needs. This type of behavior is exemplified with the idea of keeping up with the neighbors. An individual's true desires and wishes are substituted and masked with advertising and societal pressure. The question is not do I need product X? Rather the question is which brand, color, flavor of product X should I buy?

Marcuse believed these forces are part of an ever-increasing technical and rational world, which is undergirded by capitalism. The result is what he termed "Happy Consciousness" which he described as "the belief that the real is rational, and that the established system, in spite of everything, delivers the goods. . . . Conscience is absolved by reification, by the general necessity of things" (Marcuse, 1991, p. 79). Marcuse (1991) argued individuals have a soul and are capable of acting as free agents;

unfortunately, various forces perpetually act on individuals to stifle and negatively affect such individual's ability to connect to his or her true desires.

Relationship of the Individual to Society

What is the relationship between one person and another? Between individuals and the state? Who has power and who does not? Issues of power were central to Marcuse's philosophy. Just as his contemporaries in the Frankfurt School argued, Marcuse believed that individuals have little power in life given the constant influence of an increasingly rational and technical society.

In order to understand the role of individuals in society, it is necessary to first know how Marcuse understood society more broadly. First and foremost, Marcuse saw an all-encompassing adoption of a technological rationality throughout society. Technological rationality arises when technology, culture, politics, art, pushes out all alternatives or critiques. This point is critical for Marcuse because it framed his entire view of an individual's relationship with various aspects of society. He said that "private space has been invaded and whittled down by technological reality. Mass production and mass distribution claim the *entire* individual" (Marcuse, 1991, p. 10). Simply stated, society is caught up in a technological reality that both drives our systems of production and drives our systems of consumption. The technological reality claims the entire individual in that the he or she spends the vast majority of his or her time either producing goods or consuming them. In addition, technological reality shifts needs from those of the individuals to those of economic systems.

> The society which projects and undertakes the technological transformation of nature alters the base of domination by gradually replacing personal dependence

> (of the slave on the master, the serf on the lord of the manor, the lord on the donor of the fief, etc.) with dependence on the "objective order of things" (on economic laws, the market, etc.). (Marcuse, 1991, p. 144)

Marcuse argued that this resulted in false needs. Individuals are told what they need to relax, to be more productive, to be in touch with friends and family. In modern industrial societies, we do not need to look far for relevant examples. Take for instance the explosion of smartphone technology. Considered a novelty by many only 15 years ago, today these devices are nearly ubiquitous. In a 2012 study by Cisco Systems, Inc., the researchers found that “by the end of 2012, the number of mobile-connected devices will exceed the number of people on earth” (Cisco Systems, Inc., 2012, p. 1). To be clear, this is not the number of devices that have been produced since mobile phone technology was originally conceived, this is the number of devices currently in use around the world. What was once considered a novelty less than two decades ago is now considered a requirement for participation in modern society, so much so that in fact individuals may need more than one.

Building on the notion that the technological rationality claims the entire individual, Marcuse also said that the technological rationality “turns everything it touches into a potential source of progress *and* exploitation, of drudgery *and* satisfaction, of freedom *and* oppression” (1991, p. 78). Returning to the mobile smartphone example, we find that many of these devices are well suited to connect a parent and child as well as worker to boss; they are just as effective for playing games as they are at responding to corporate email systems. The devices are able to deliver the news as well as material goods to one's home. The line between work and leisure, production and consumption continues to blur in a techno-rational society.

All of this was problematic for Marcuse (1991). Individuals are no longer able to express their true needs. Any frustration with the system is pacified with a greater standard of living and an increased ability to consume. Something that Taylor (2011) explicitly promoted. As a result, an individual's relationship to society is comprised essentially in their ability to participate as a producer and consumer. Any notions of individual power or cooperation with others are framed within the context of the dominant system of thought.

Nature of Technology

What was Marcuse's view as it relates to the nature of technology? Is technology value neutral or value laden? Does technology drive us in certain ways or are we in control? Marcuse's view of technology was particularly nuanced. Even scholars in the field of philosophy of technology debate many of the specifics of Marcuse's view. For the sake of making progress in the discussion, rather than elaborate on all the contentious bits, the following analysis will uncover the major themes and essence of his view of the nature of technology.

First, it should be made clear that Marcuse's work was foundational with regard to thinking in these terms about the nature of technology. Few scholars had attempted to address the nature of technology before his era. That is not to say that his contemporaries were not engaged in similar work; rather, Marcuse was on the leading edge of a movement of this type of philosophical inquiry. Influenced by Heidegger's philosophy of technology, Marcuse attempted to fill in many of the gaps left by Heidegger and Marx in terms of a unified philosophy of technology.

Returning to the opening quote for this chapter, Marcuse argued that science and scientific method comes from a particular universe of discourse and action. In modern times, society has come to see this particular discourse as the only lens from which to understand the world. It separates truth from opinion, fact from feeling. Additionally, it exerts a certain control over individuals. Marcuse stated:

> Science, *by virtue of its own method* and concept, has projected and promoted a universe in which the domination of nature has remained linked to the domination of man—a link which tends to be fatal to this universe as a whole. (1991, p. 166)

This control manifests in several important ways already discussed in terms of false needs, happy consciousness, and one-dimensional thinking. In this sense, technology exerts control over society. It is important to recognize that Marcuse tied both technology and economic systems together as one powerful force. This was clearly a conceptual link that came from Marxism. Regardless, for Marcuse, it was this alliance with the underlying economic structure that allows technology its power over individuals. Marcuse said that "technology serves to institute new, more effective, and more pleasant forms of social control and social cohesion" (1991, p. xlvii). All of which is directly connected to our ability to produce and consume material goods.

Technological rationality also serves to frame a specific view of nature. Under a technological rationality, nature is something to be harnessed and utilized in more productive and efficient ways. One-dimensional thinking drives decisions, policies, and action, unfortunately all at the expense of rational alternatives. Marcuse stated:

> The quantification of nature, which led to its explication in terms of mathematical structures, separated reality from all inherit ends and consequently, separated the true from the good, science from ethics. No matter how science may now define objectivity of nature and the interrelations among its parts, it cannot scientifically conceive it in terms of "final causes." (1991, p. 146)

Stated another way, science views nature as a means to scientific ends. Natural resources are just that, resources to be utilized in service of science. One example of this type of thinking is the extraction of carbon-based energy such as coal, natural gas, and crude oil from the earth. The traditional view of science has been to utilize this resource at an ever-increasing rate, while attempting to mitigate any environmental harm with better science. Had the question be framed differently, should society develop systems that are largely dependent on a finite resource that took millions of years to create and will likely be exhausted in a few hundred years? It may have yielded a different result. Science asks what do we have to gain from utilizing our natural resources, often at the expense and exclusion of questions that ask what do we have to lose by utilizing our natural resources.

Clearly for Marcuse, techno-rational thinking had a certain trajectory, but at the core did Marcuse believe technology had certain values? Here is where there is disagreement among scholars about Marcuse's view of the value neutral nature of technology. On the one hand, there is evidence to support the view that technology is neutral and it is only how it is utilized by those in power that give it influence over individuals. This view is congruent with a traditional Marxist view of technology. For example, Ocay (2010) argued that Marcuse viewed technology as value neutral, but it did have a “propensity to become a tool for emancipation and a tool for domination” (p. 57). In these terms, it is the association of technology with a specific economic system or political structures that gives technology values, not the tool itself. On the other hand there is evidence (Feenberg, 1991) that Marcuse believed the influence extended beyond the specific ties to an economic or political system. From this perspective it follows that techno-rational thinking shapes and manipulates even those in power. This view makes sense given Marcuse’s was a student of Heidegger (1977). As mentioned in Chapter I, Heidegger was focused on the hidden nature of technology's essence. He termed this essence *gestell*, an enframing or all-encompassing view of technology’s mode of existence. Heidegger felt this enframing shaped every aspect of our thoughts and actions. Regardless of how one sides, Marcuse believed there were consequences of techno-rational thinking and its total domination of both individual and economic systems.

So where did Marcuse fall on Feenberg’s (1991) model? As I mentioned earlier, his position is often debated among scholars. Rather than muddle through the details and contradictions of Marcuse’s view, it is more fruitful to elevate a more succinct view that aligns with the spirit of Marcuse in terms of his philosophy of technology. Thankfully, Feenberg (1991) attempted to fill in some of the theoretical gaps left by Marcuse. Ultimately, Feenberg (1991) argued that Marcuse was aiming for a critical theory of technology or value-laden but under human control. Arguing from this position acknowledges that technology is value laden and potentially autonomous if we, through our passivity, allow it to be. Here, the belief is that technology will control us if we allow it. It is up to us to critically analyze the values of technology and question the assumptions we make about technology and its subsequent adoption.

In his book *Critical Theory of Technology*, Feenberg (1991) actually grounded this idea of multiple ends based on public discourse and critical inquiry. He commented that at the heart of critical theory of technology the real issue was not technology or progress, rather the variety of possible technologies and paths of progress among which we must choose. He continued to argue that modern technology was no more neutral than "medieval cathedrals or The Great Wall of China; it embodies the values of a particular industrial civilization and especially of its elites, which rest their claims to hegemony on technical mastery" (Feenberg, 2003, p. v). He continued that we must articulate and judge these values in a cultural critique of technology. By so doing, we can begin to grasp the outlines of another possible industrial civilization based on other values (Feenberg, 1991).

But all hope is not lost for Marcuse either. He envisioned a world where technology can serve as a tool to liberate society from the technology rationality that currently plagues it. This will occur when society revolts against one-dimensional thinking and begins including reasonable alternatives as part of a more complete discussion about the economic and technical systems we enroll. Several of these reasonable alternatives will be discussed in Chapter V.

Aims of Education

What are the purposes of education? Are people blank slates? What forms should education take? Does Marcuse's thinking tend to associate with a particular philosophy of education? While he did not explicitly discuss education or educational methods with any depth, he clearly had a vision for education as a means of liberating individuals from the bond of one-dimensional thinking.

It is worth beginning the discussion with an acknowledgement that Marcuse saw current educational practices and formal educational institutions as a means of reifying a techno-rational mindset. Marcuse argued that within all major institutions in modern industrial societies there was "a trend toward consummation of technical rationality, and intensive efforts to contain this trend within the established institutions" (1991, p. 17). Education is not immune and in fact is one of the principal means of conditioning individuals to focus on one-dimensional thought.

Broadly speaking, Marcuse would fall under the label of reconstructionism. Simply stated, social reconstructionism is a philosophy of education that emphasizes the critical engagement of current practice with an emphasis on social action to bring about change. More specifically, Marcuse would fall into a subset of reconstructionist that adheres more closely to the critical theory movement. Like social reconstructionists, critical theorists believe that educational systems must be critiqued and rebuilt in order to overcome social oppression and increase human autonomy. While Marcuse does not outline a detailed road map for change in education, he does spend considerable time discussing what he called the great refusal. While this great refusal was discussed in terms of a new social order, it does have very clear implications for education.

This great refusal was nothing short of a revolution and begins with establishing a radically new way of thinking, a new rationality that fundamentally shifts away from one-dimensional techno-rational worldview. This shift would also need to occur in educational practice and educational institutions. As outlined above in the section on Marcuse and truth, it would require a radical critique of language, thought, and practice in order to reveal alternatives and combat all forms of social control and domination.

This critique in education is often referred to as critical pedagogy. Grounded in the work of early critical theory, critical pedagogy's aim is to deconstruct educational practice to reveal issues around social control, history, and power.

Second, Marcuse would argue that educational practice should return to a system grounded in dialectical method. Rather than focusing on facts and figures, educational practice should return to a method that seeks truth based on reason and logic. Given his affinity for classical philosophy, it is reasonable to assume Marcuse would advocate for an education that made substantive contact with this type of philosophy. All with the aim of understanding reason and logic as a means of revealing truth. Marcuse often called on the work of Plato, Rousseau, Kant, Hegel, Marx, and others as means of grounding arguments and ideas.

Another way Marcuse hoped to achieve the great refusal was by focusing more on art and expression as way to make meaning from the world. Rather than rely on facts and formulas as the sole means of understanding concepts, society should engage in alternative, artistic ways of constructing meaning. Kellner (2006) argued Marcuse frequently "valorized alternative practices, in this case stressing the importance of play, education of the senses, and cultivation of the imagination for an emancipatory pedagogy" (p. 3). In this way, educational practitioners could learn and borrow from other educational movements such as Waldorf schools. Waldorf schools are focused on experiential learning that is artistic and imaginative. At the core, the approach emphasizes developing children's emotional life and artistic expression across a wide variety of performing and visual arts (Nielsen, 2006). This type of approach could clearly help inform mainstream education.

Another important aspect of the great refusal would be to decentralize control of schools. Rather than educational practices being mandated at either the state or national level, the methods and curriculum would come primarily from the local educators and community. Marcuse would have argued that all matters of curriculum should be local, needs based, expression focused, and critical of language, history, and technology. It is important to make clear that education will still include technology. Nowhere did Marcuse argue that we should return to a time before technology; rather, Marcuse argued we need to reframe technology as well as decouple it from the economic system.

Conclusion

The focus of this chapter was to unpack Marcuse's beliefs around five key domains: truth, human nature, relationship to society, nature of technology, and the aim of education. As discussed, Marcuse's views were representative of a particular way of thinking about technology that coincides historically with both the growth of critical theory and the introduction of more modern educational technology in schools. Positioning his view on several theoretical planes, that of philosophy, educational philosophy, and philosophy of technology, gives means, language, and context to discuss the differences between his views and Taylor's.

CHAPTER IV

UNDERLYING ASSUMPTIONS

> Part of the purpose for exploring these hidden premises, assumptions, and prejudices is that evaluating an idea, or an entire system of thought, involves evaluating its presuppositions, and its implications as well (Burbules & Warnick, 2006, p. 493).

With the conversation started, it is important to extend this type of analysis in meaningful ways so leaders in the field can engage critically with the nature of technology and techno-rational thought in practice. This type of engagement involves revealing the hidden premises, assumptions, and prejudices surrounding technology and technology policy in education. These ideas guided the third research question that asked what are the legacies and implications of Taylor's (2011) and Marcuse's (1991) ideas for current issues in educational technology? To that end, this chapter revealed the legacies of Taylor's (2011) way of thinking reflected in four large-scale educational technology plans. In addition, Marcuse (1991) will be brought in to provide a counterpoint or a way of critically analyzing Taylor's (2011) influence. The discussion was framed around the five themes of analysis identified in Chapter I.

In order to demonstrate the legacies of techno-rational thinking in the field of educational technology, four national educational technology plans (NETP) (U.S. Department of Education [USDOE], 1996, 2000b, 2004, 2010) were placed under the same type of critically oriented content analysis utilized in Chapters II and III. This type of critical engagement with the NETPs aided in identifying the legacies of Taylor's

(2011) thinking and revealed many of the current underlying assumptions surrounding technology in education.

Background

Each of the four plans were initiated by the Office of Educational Technology (OET) under the U.S. Department of Education. While each of the four plans were authored in different historical and political contexts and stood on their own with regard to their area of focus for teaching and learning with technology, there were several important parallels among all four NETPs that demonstrated a strong connection to techno-rational thinking. The subsequent analysis of the four plans revealed both the dominance of techno-rational thought as well as a lack of critically oriented perspectives.

For the sake of this discussion, the introduction of each plan focused on two key aspects: First, a brief discussion of the historical and political context of each plan; and second, a summary of the stated contributors to the plans. This background information helped situate the plans before beginning a more thorough analysis. The remainder of the chapter focuses on a summary of the content analysis based on the five themes of analysis outlined in Chapter I: truth, human nature, role in society, nature of technology, and aims of education. The analysis of the four technology plans was meant to be illustrative, not exhaustive.

1996 National Educational Technology Plan

The first national educational technology plan, entitled *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge* (USDOE, 1996) broadly focused on technology literacy for all students. This plan was grounded in the belief that students needed to be technology literate in order to fully compete in a growing technological world. At the time the plan was authored, less than 9% of K-12 classrooms had internet access (USDOE, 1996, p. 9).

As part of their preparation, the OET included participation from educators and technology industry leaders across the country. In addition, they solicited feedback:

> Seven regional forums brought together more than a thousand parents, teachers, business leaders, technology experts and researchers. These citizens submitted documents, made public statements, engaged in broad-ranging discussions, and provided us with a diverse tapestry of ideas, experiences, and concerns from regions all across America. (USDOE, 1996, p. 58)

While the authors talked about a diverse tapestry of ideas and concerns, the critical issues—identified in the plan itself—were centered on problems of equal access and appropriate funding. This makes sense given the plan was written at a time when there was a technological divide and not all schools had equal access to basic technology. Moreover, the notion of long-term educational technology budgets was in its infancy. As a result, school technology budgets were often underfunded, especially in the context of the NETP's goals.

2000 National Educational Technology Plan

Four years later, the Office of Educational Technology authored a plan focused on distance learning. In *E-learning: Putting a World-Class Education at the Fingertips of All Children* (USDOE, 2000b), the plan outlined five goals to serve as a roadmap for a national strategy for the effective use of technology in elementary and secondary education. By the fall of 2000, nearly all public schools were connected to the internet. (Cattagni & Farris, 2001). Unfortunately, only 10% of teachers had more than five computers in their classrooms (USDOE, 2000a). The creators of the plan linked their work directly to the progress already achieved by the 1996 plan and laid out a roadmap for the next decade in American education.

In an effort to include a variety of perspectives, the authors of the 2000 plan widened the scope of contributors. They developed the plan "in consultation with the full range of stakeholders: educators, researchers, policymakers, students, parents, and leaders from higher education, industry and other areas" (USDOE, 2000, p. 70). Similar to the 1996 NETP, the authors explicitly linked the need for technology in education to the gains resulting from technology in business and industry.

2004 National Educational Technology Plan

Four years later, the OET released an NETP focused on closing the achievement gap in American education with technology. In *Toward A New Golden Age In American Education-How the Internet, the Law and Today's Students Are Revolutionizing Expectations* (USDOE, 2004) the focus was on seven initiatives aimed at achieving and reporting the goals of No Child Left Behind (NCLB) legislation. At the time the plan was authored, nearly all schools were wired for internet access (Rathbun et al., 2003) and a growing number of K-12 public schools offered some form of e-learning or virtual school instruction (Botelho, 2004). As a result of the growth in e-learning, the authors sought to build on that momentum to address many of the initiatives as outlined in NCLB.

Similar to the 1996 and 2000 plans, the authors of the 2004 plan "actively sought out the advice and insights of a broad range of stakeholders, including students, educators, researchers, parents, higher education and industry leaders" (USDOE, 2004,

p. 51). Over the course of the development of the 2004 NETP, the authors stated they received input from over "1,500 individuals and organizational representatives, including from dozens of leading education associations and industry representatives" (USDOE, 2004, p. 51).

2010 National Educational Technology Plan

The most recent plan, *Transforming American Education: Learning Powered by Technology,* was published in 2010. One of the key motivations for the 2010 plan was related to the perception that America was falling behind other nations in terms of college graduation rates. The plan cited President Obama's goal of leading the world in the proportion of college graduates by 2020 as one of the driving forces for building an educational system firmly grounded in technology.

The plan was released by the OET and was developed with the assistance of a technical working group of leading education researchers and practitioners. In addition, the authors utilized "the most rigorous and inclusive process ever undertaken" (USDOE, 2010, p. xv) to solicit participation from more people in a variety of fields. It achieved this goal by utilizing "broad outreach efforts and state-of-the-art communications and collaboration technology enabled tens of thousands of individuals to learn about and contribute to the development of the plan over its 9-month development period" (USDOE, 2010, p. xv).

The following section will discuss the four plans in terms of the five themes of analysis. When we unpack the NETPs in terms of the five themes of analysis identified in Chapter I, we begin to see alignment with Taylor (2011) and techno-rational thinking.

Understanding of Truth

As discussed earlier, how one constructs facts is central to framing meaning, arguments, decisions, and practice. Did the authors of the NETPs believe truth was based on reason alone or physical observation and experience? Unpacking the how the authors of the NETPs constructed facts will expose their underlying assumptions about truth.

The analysis revealed that all four plans were consistent in how the authors constructed truth based on quantitative, data driven research. While each plan had a different take on how this could be accomplished, there was clearly a focus on measurable quantifiable facts. In addition, all four plans called for the need to establish a base of quantitative research with the collaboration of various institutions to understand and disseminate best practices in educational technology. To that end the authors of the 1996 NETP stated,

> Universities, the private sector and research centers can continue to engage in and sponsor research on the use of technology in education to ensure an adequate base of research to guide school efforts. To ensure that research addresses critical issues in educational technology, researchers can collaborate with schools and educators to focus on key issues. (USDOE, 1996, p. 49)

Subsequent plans focused more explicitly on systematic measurement using technology. This type of thinking is clearly linked to Taylor (2011) and his scientific management. The authors of the 2000 plan argued:

> While we have learned a tremendous amount about the implementation and use of technologies for teaching and learning in the past few years, the need for an expanded, ongoing national research and evaluation program to improve the next

> generation of technology applications for teaching and learning is profound. (USDOE, 2000, p. 6)

Additionally they stated the focus should be on “Empirical studies—conducted in schools and classrooms—designed to determine which approaches to the use of technology are most effective and under which conditions with which students” (USDOE, 2000, p. 44). This type of thinking is strikingly similar to Taylor’s (2011) method of studying the actions of the workmen to find the most productive and efficient ways of completing specific tasks.

By 2004, more educational functions moved online and as a result, access to greater quantities of data were available to administrators and educators. The authors of the 2004 plan argued schools should “Use data from both administrative and instructional systems to understand relationships between decisions, allocation of resources and student achievement” (USDOE, 2004, p. 44). By the fourth NETP, the authors noted “our education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement” (USDOE, 2010, p. xvii).

The implication for this view is that if the technology cannot measure it, it must not matter. In other words, facts that are not observable, quantifiable, and/or able to be captured by technology exist outside the realm of truth and therefore are not important. This notion is a direct reflection of Taylor (2011) and how he constructed meaning with scientific management. By using stopwatches and direct observation to quantify the actions of individuals Taylor was able to construct facts about people and their abilities. This coupled with constant reporting about the actions and progress of shop workers allowed the shop managers and efficiency experts to make detailed plans and adjust the routines to reflect changes in productivity.

This need for constant streams of information is also echoed in the 2010 NETP. The authors of the 2010 plan argued that "student-learning data can be collected and used to continually improve learning outcomes and productivity. . . . For this to work, relevant data must be made available to the right people at the right time and in the right form" (USDOE, 2010, p. xi). Granted, Taylor's (2011) method was far more limited in scope given that it focused on factory workers, but the core of his argument was the same. In a sense, Taylor's vision for extending scientific management into all aspects of society still resonates in these plans.

One of the central issues for Marcuse was the role that language plays in our ability to comprehend truth. When the authors of the plan used positivist language to frame education in terms of facts and figures, it essentially eradicates the ability to reframe the discussion with logical alternatives. For the authors of this plan, the facts speak for themselves; moreover, they are the only things worth talking about. When this occurs, the language is limiting and fixed. Marcuse argued that "where these reduced concepts govern the analysis of the human reality, individual or social, mental or material, they arrive at a false concreteness- a concreteness isolated from the conditions which constitute its reality" (1991, p. 106). Given the NETPs relied on positivist language as their understanding of truth, it unavoidably excluded discussions about the nature of technology or any for that matter. In fact the author argued for constant streams of quantitative data in order to drive educational decisions.

Concepts of Human Nature

Did the authors of the four NETPs believe individuals are innately irrational, good, or lazy? Do individuals have free will? Are we created equal? Are people by nature competitive or cooperative? The analysis of the four NETPs did not reveal any significant discussions related to concepts of human nature.

The lack of explicit ties to specific views of human nature could be intentional, a necessary aspect of attempting to build consensuses and buy-in across a broad base of educational stakeholders by avoiding controversy. It could be that the authors felt it was outside the scope of their field or the aims of a federal educational technology policy. Additionally, it is also possible that the authors were not concerned with recognizing any particular view since technology is believed to be neutral. The thinking follows that technology could be used to meet the aims of any view of human nature. Individuals can be cooperative, lazy, have a fixed intelligence; in terms of the policy it does not matter. Regardless, there was little overt language that would explicitly tie the plans to any one view of human nature.

Relationship of the Individual to Society

What is the relationship between one person and another? Between individuals and the state? Who has power and who does not? Issues of power were more nuanced for the NETP authors. The authors of the plans primary concern focused on an individual's ability to adequately participate in increasingly technological economic systems. The authors of the plans see technology ushering in a new social order, one that will increase the quality of life and standard of living for many. In addition, there is a belief that technology and technology literacy will level the educational playing field.

Take statements such as "they've got to have access. The internet can either be the great equalizer, or just another missed opportunity . . . access makes the difference" (USDOE, 2000, p. 36). The 2004 NETP reads along similar lines:

> With the benefits of technology, highly trained teachers, a motivated student body and the requirements of No Child Left Behind, the next 10 years could see a spectacular rise in achievement—and may usher in a new golden age for American education. (USDOE, 2004, p. 46).

There is a belief that technology in schools can close the achievement gap and give all students—assuming they have access—an equal chance to succeed in a global economy.

This new social order will increase the productivity and efficiency of businesses and schools. All four plans argued the shifts in business and industry attributed to modern computer technology were slow to find their way in education. In order to reap the social benefits afforded by technology and compete in these increasingly technical economies, schools needed to catch up. The authors of the 1996 plan stated that

> The United States and the world are now in the midst of an economic and social revolution every bit as sweeping as any that has gone before: computers and information technologies are transforming nearly every aspect of American life. They are changing the way Americans work and play, increasing productivity, and creating entirely new ways of doing things. Every major U.S. industry has begun to rely heavily on computers and telecommunications to do its work. But so far, America's schools have been an exception to this information revolution. (USDOE, 1996, p. 11)

This sentiment is repeated again in the 2000 NETP. The authors contended that "at the dawn of the 21st century, we are still at the beginnings of a technological revolution that is bringing dramatic changes to our society" (USDOE, 2000, p. 44). The 2004 plan followed suit arguing that "in the realm of technology, the educational community is playing catch-up. Industry is far ahead of education" (USDOE, 2004, p. 45). Finally, in the 2010 plan, the authors stated that "education can learn much from such industries as business and entertainment about leveraging technology to continuously improve learning outcomes while increasing the productivity of our education system at all levels" (USDOE, 2010, p. 5).

The notion of education playing catch up to business and industry is tied to an improved quality of life. In the 2010 plan, the authors made this connection explicit: "Education is the key to America's economic growth and prosperity and to our ability to compete in the global economy. It is the path to good jobs and higher earning power for Americans" (USDOE, 2010, p. 1). If one analyzes the language around this statement and statements like it throughout the plans, it becomes clear that the authors believed an increased productivity, both economically and educationally, and a new social order are possible through technology in education. The authors explicitly combined the technological gains in industry to education and articulated the importance of realizing those same gains in schools.

This type of thinking is a direct reflection of Taylor (2011) and his view of capitalism. Recall that Taylor (2011) believed that his system would create a better, more efficient, and productive world. He believed his system of scientific management was at the heart of a new and wonderful era. Taylor said that "in the past the man has been first;

in the future the system must be first. . . . The first object of any good system must be that of developing first class men" (Taylor, 2011, p. 8). For Taylor and the authors of the NETPs, the role of the individual is to be a productive and willing participant in a global economy. By making workers more productive and efficient, society can raise the quality of life for many individuals.

Marcuse felt this type of relationship to capitalism serves to turn "everything it touches into a potential source of progress *and* exploitation, of drudgery *and* satisfaction, of freedom *and* oppression" (1991, p. 78). Technology and techno-rational thinking are literally shaping our word in ways we are not aware of and may not intend. Marcuse continued this point,

> The products indoctrinate and manipulate; they promote a false consciousness which is immune against its falsehood. And as these beneficial products become available to more individuals in more social classes, the indoctrination they carry ceases to be publicity; it becomes a way of life. It is a good way of life - much better than before - and as a good way of life, it militates against qualitative change. Thus emerges a pattern of *one-dimensional thought and behavior* in which ideas, aspirations, and objectives that, by their content, transcend the established universe of discourse and action are either repelled or reduced to terms of this universe. (1991, p. 12)

Simply stated, the improved standard of living afforded by the increased engagement with production and consumption—what Taylor (2011) argued for— in fact pacifies the individual and their ability to engage in ones own needs and desires.

Nature of Technology

What view(s) surrounding the nature of technology are present in the NETPs? Is technology value-neutral or value-laden? Is technology a sign of progress? The answers to these philosophical questions are clearly articulated in all four NETPs. In the following section, I provide evidence to demonstrate that the four NETPs resonate with neutral-deterministic language and techno-rational thinking.

First is the question of the neutrality of technology in education. Here, what is not being discussed is more revealing than what is. In each of the four plans there is clear evidence that discussions about the nature of technology were not necessary. These statements reinforced the futility of discussing the nature of technology in education. In the 2000 NETP, then Secretary Riley of the U.S. Department of Education stated, "this debate has never been about technology" (USDOE, 2000, p. 32). This statement implied that there is universal agreement that technology is at the very least value-neutral, if not implying technology is a good thing in and of itself. When placed under the lens of a critically oriented perspective, a statement like Secretary Riley's begs the question why has the debate not been about technology? What perspectives and viewpoints have gone unheard as a result of excluding the philosophy of technology as a critical component of the conversation around technology in education? Marcuse (1991) would see this as a clear sign of one-dimensional thinking.

This view of technology was also demonstrated by the fact that there were no explicit conversations or even an acknowledgment of the nature of technology in any of the four plans. Given the powerful claims made by the authors surrounding technology in education, one would expect to find, at the very least, an acknowledgement of the possibility that technology may in fact carry with it certain values. Instead, the authors seemed to assume a universal agreement that technology is value-neutral. Statements such as, "if we take advantage of the opportunities presented to us, technology will enhance learning and improve student achievement for all students" (USDOE, 2000, p. 31) follow in this vein. Technology is clearly viewed as neutral tool to be utilized by educators and administrators.

The second idea related to the nature of technology present in all four plans is the idea that technology adoption is a sign of progress, even an imperative. As discussed in Chapter I, Pacey (1983) argued the technological imperative is commonly taken as "the lure of always pushing toward the greatest feat of technical performance or complexity which is currently available" (p. 79). Stated another way, because a particular technology gives one the capacity to do something—meaning it is technically possible—then this something either ought to, must, or inevitably will, become a technological reality.

With each subsequent plan the notion of the technological imperative becomes stronger and more explicit. In the 2000 NETP, the authors argued that "the use of technology in education must remain a national priority. It must be at the core of the educational experience, not at the periphery" (USDOE, 2000, p. 7). The tone of these statements continued: "If technology is to achieve genuinely transforming improvements in schooling for all students, it must be at the center of school reform and improvement efforts" (USDOE, 2000, p. 11). This commitment to the progress afforded by technology continued in the 2004 plan. President George W. Bush stated: "We cannot assume that our schools will naturally drift toward using technology effectively. We must commit ourselves to staying the course and making the changes necessary to reach our goals of educating every child" (USDOE, 2004, p. 37). The authors of the 2010 plan continued in the same vein stating that technology "is at the core of virtually every aspect of our daily lives and work, and we must leverage it" (USDOE, 2010, p. ix). The authors of the 2010 NETP argued technology adoption in schools was in fact a national crisis:

> The NETP accepts that we do not have the luxury of time: We must act now and commit to fine-tuning and midcourse corrections as we go. . . . As we enter the second decade of the 21st century, there has never been a more pressing need to transform American education or a better time to act. (USDOE, 2010, p. xv)

The language used in the plans speaks volumes to the urgency felt with regard to adopting technology in education, terms like must, national priority, at the center, and at the core, all resonate with the technological imperative. Technology as a sign of progress is explicitly connected to the techno-rational and one-dimensional thought identified earlier. Taylor (2011) believed in the power of technology and argued that technology coupled with technical thinking could cultivate the economy, make the world more productive and efficient, and increase the quality of life for many. In other words, why would policymakers and educators not want to adopt technology?

Part of the issue for Marcuse (1991) is that as new technologies are adopted and integrated in various aspect of society, the change is permanent and inevitably distorts the original aims. He remarked,

> The change reveals its depth and the degree of its irreversibility if it is seen as a result of technical progress. The present stage redefines the possibilities of man and nature in accordance with the new means available for their realization than,

> in their light, the pre-technological images are losing their power. (Marcuse, 1991, p. 65)

Because the adoption of technology in education is seen as necessary and a sign of progress it redefines success in education. In other words, "the means prejudice the end" (Marcuse 1991, p. 42).

Aims of Education

What are the purposes of education? Are people blank slates? What forms should education take? Did the authors' thinking tend to associate with a particular philosophy of education? There are three important points with regard to the NETPs and this theme. First is the strong connection to a positivist philosophy. This claim is largely supported by how the authors of the plans viewed facts and truth outlined previously in this chapter. The second point is the absence of any explicit ties to a particular educational movement or established educational philosophy. It could be argued this was actually intentionally done to avoid controversy. The third, and most important, point is the emergence of an entirely new philosophy of education focused on technology.

The first salient point is the strong connection to positivism. To reiterate, positivists believe that sensory experiences measured through scientific means is the exclusive source of all worthwhile information. Collins and O'Brien (2003) argued that positivism in educational organizations "reinforces the notion of education being run as machine or in assembly line fashion. Positivism is characterized by top-down management; linear, sequential curriculum; strict time schedules; and departmentalization" (p. 360). The parallels are unambiguous; all four NETPs reflected this way of thinking. Standardized curriculum designed by experts, frequent standardized assessment of students, systematic tracking of student progress, frequent reporting of data, and increasing bureaucratic educational systems are all prominent features of the four NETPs. This philosophy undergirded many of the assumptions made by the authors of the plans.

The second point was the lack of explicit ties to a particular educational movement or established educational philosophy. It could be argued this was done intentionally, a necessary aspect of attempting to build consensus and buy-in across a broad base of educational stakeholders. If a plan sounded too much like Skinner (1987) or Dewey (1966) it would polarize educators and policymakers. It is also possible that the authors were not concerned with recognizing any particular educational philosophy since technology is believed to be neutral. The thinking follows technology could be used to meet the aims of any educational theory. Regardless, there was little overt language that would explicitly tie the plans to any one established educational philosophy.

The third salient point centers on what the authors made explicit about the purposes of education. Throughout all four plans, the authors identified a new purpose for education that was centered on technology literacy, access, and adoption. It could be argued that what was reflected in the NETPs is the emergence of an entirely new era of educational aims. The fact is, prior to 1996 there were no educational technology plans at the federal level. Most schools were not wired and technology in education was largely a complement to existing methods. Simply stated, it was never about the technology. Over the past 20 years that has changed. In fact, all four plans argued that it is about the technology. Moreover, the authors contended that educators should put technology at the center of the curriculum. A more in depth analysis around the emergence of a new era in education focused on technology, while directly relevant to this project, is beyond the scope. Instead, the following section will demonstrate the tone and discourse of the aims of education directly reflected in the four NETPs.

So what views and themes are reflected in the plan? In a sense, the language used builds directly on the themes discussed in the previous section and the plans strong ties to business, industry and capitalism. Beginning with the 1996 NETP, the authors called for a shift in the aims of education to make technology literacy a new core function of schools. In the introductory letter to Congress for the 1996 plan, Secretary of Education Riley argued that, "Computers are the 'new basic' of American education, and the Internet is the blackboard of the future" (USDOE, 1996, p. 3). The authors of the plan continued:

> As advances in technology race ahead, we must ensure that the nation's students become technologically literate. Not to meet this challenge will mean that American students will only fall further and further behind. With reading, writing, and arithmetic, technology has become the nation's "new basic." Our children's future, the future economic health of the nation, and the competence of America's future workforce depend on our meeting this challenge. (USDOE, 1996, p. 7)

The authors of the plan contended that education should follow the lead established by business and industry and technology literacy should be the new basic skill in American education. Moreover, to fall behind by not adopting technology in school would be unacceptable.

This focus for education was repeated in the 2000 NETP. Again drawing explicit ties to business and industry, the authors called for the addition of technology skills to the core purposes of education. The authors argued that

> The 21st Century Workforce Commission concluded that nothing less than the future health of America's 21st-century economy depends directly on how broadly and deeply Americans reach a new level of literacy that includes not only strong basic academic skills, but also thinking, reasoning and teamwork skills, as well as proficiency in using technology. (USDOE, 2000, p. 40)

The authors of the 2000 plan continued: "One purpose of elementary and secondary education is to provide students with the skills they need to become productive members of the workforce" (USDOE, 2000, p. 44). It is also interesting to note that in addition to technology literacy being at the core of the production or workforce side of the equation, it was also articulated at the consumption side as well. The authors of the 2000 plan made this aim obvious when they stated:

> On the individual level, technology and information literacy skills will help consumers better assess products and make more intelligent buying decisions. And, on the societal level, technology and information literacy skills should help citizens make better decisions through heightened understanding of the scientific and technological foundations of many public policy issues facing the nation and the world. (USDOE, 2000, p. 40)

In other words, not only should the aim of education be educating people to be technology literate producers, we also need to teach techno-rational thinking and educate individuals to be better consumers of technology. None of the plans discussed rejecting technology, rather the focus was on producing and consuming more technology, our global economy requires it.

Recall that Marcuse (1991) articulated an all-encompassing adoption of a technological rationality throughout society. He argued that technological rationality arises when technology, culture, politics, art, pushes out all alternatives or critiques. This point is critical for Marcuse because it framed his entire view of an individual's relationship with various aspects of society. He said that "private space has been invaded and whittled down by technological reality. Mass production and mass distribution claim the *entire* individual" (Marcuse, 1991, p. 10). For Marcuse, society is caught up in a technological reality that both drives our systems of production and drives our systems of consumption.

> The distinguishing feature of advanced industrial society is its effective suffocation of those needs which demand liberation-liberation also from that which is tolerable and rewarding and comfortable-while it sustains and absolves the destructive power and repressive function of the affluent society. Here, the social controls exact the overwhelming need for the production and consumption of waste; the need for stupefying work where it is no longer a real necessity; the need for modes of relaxation which soothe and prolong this stupefication; the need for maintaining such deceptive liberties as free competition at administered prices, a free press which censors itself, free choice between brands and gadgets. (Marcuse, 1991, p. 10)

The technological reality claims the entire individual in that the he or she spends the vast majority of his or her time either producing goods or consuming them. In addition, technological reality shifts needs from those of the individuals to those of economic systems.

Again in the 2004 NETP that authors extend this thinking and argue that technology will be at the core of all human activities:

> Over the next decade, the United States will face ever increasing competition in the global economy. To an overwhelming extent, this competition will involve the mastery and application of new technologies in virtually every field of human endeavor. (USDOE, 2004, p. 6)

If we briefly compare this statement with that of Taylor's (2011) vision we find some striking similarities. Remember that Taylor argued in 1911 that technology and technological thinking

> Can be applied with equal force to all social activities: to the management of our homes; the management of our farms; the management of the business of our tradesman, large and small; of our churches, our philanthropic institutions, our universities and our governmental departments. (2011, p. 9)

By the writing of the 2010 NETP, technology appears to drive educational policy. The authors of the 2010 plan stated that "the challenging and rapidly changing demands of our global economy tell us what people need to know and who needs to learn" (USDOE, 2010, p. x). In other words the technical demands of our world and economy in fact dictate what we teach in our schools and to whom.

Conclusion

Before concluding this chapter, it is worth noting that the authors of the NETPs not only aligned with techno-rational thinking, they also specifically advocated for the rejection of alternative ways of framing technology in education. They argued educators and policy makers needed to stop impeding progress. "Now is the time to renew our commitment to the future by challenging the nation to take bold action in hastening the coming of the future of education" (USDOE, 2000, p. 7). In the 2010 NETP, they told educators to "rethink basic assumptions in our education system that inhibit leveraging technology to improve learning" (USDOE, 2010, p. 73). Clearly this focus leaves little room for objections about technology in education. Moreover, the authors of the plans argued for a more rapid timeline for adoption of technology in education. The authors of the 2010 NETP stated that "we must act now and commit to fine-tuning and midcourse corrections as we go" (USDOE, 2010, p. xv). This implied that to be thoughtful about adopting technology in education is a waste of time. Later in the plan they argued:

> We must apply the core principles of process redesign to quickly evaluate our education system for effectiveness, efficiency, and flexibility and design and implement new processes where needed. We must monitor and measure our performance to continually improve learning outcomes while managing costs. We must hold ourselves accountable. To do all these things, we must apply the advanced technology available in our daily lives to student learning and to our entire education system. (USDOE, 2010, p. 3)

If accepted at face value, this process cannot accommodate the type of thoughtful multi-dimensional thinking that Marcuse (1996) called for in his critique. The method the authors of the plan advocated for is one-dimensional; purely technical in nature, data-driven, and therefore could not acknowledge alternative perspectives. Moreover, it collapses the discussion to merely one-dimensional thinking. Marcuse argued this collapsing of multi-dimensional language is occurring with greater frequency and that "multi-dimensional language is made into one-dimensional language, in which different and conflicting meanings no longer interpenetrate but are kept apart; the explosive historical dimension of meaning is silenced" (1991, p. 198).

In summary, each of the four plans demonstrated clear evidence of a techno-rational view. In each of the plans there was a belief that technology is a sign of progress and will provide value for teaching and learning. How should practitioners and policymakers proceed? First policymakers and practitioners must recognize the underlying assumptions surrounding how educational technology is framed, effectiveness assessed, and judgments made about its potential. It is critical to acknowledge that current thinking in the field is grounded in science and techno-rational thought. As a result, essential reference points such as the origins of the field, the nature of technology, and alternative critical frameworks are often excluded. Without these alternatives, the field of educational technology has been largely confined to one-dimensional thinking around issues of technology in education. In the following chapter, dialectical analysis of several emerging educational technology will be explored and four concrete ideas will be put forward with the aim of better engaging the field of educational technology in a critical discourse and action.

CHAPTER V

CONCLUSION

> To think dialectically is to invite the juxtaposition of opposed or contradictory ideas, to interact with the tensions invoked by these contesting arguments, or to engage in the play of ideas. The arguments and ideas that are engaged in this dialectic stance emanate from the assumptions that constitute philosophical paradigms—assumptions about the social world, social knowledge, and the purpose of science in society. (Greene & Caracelli, 2003, p. 96)

In the previous chapter the prevalence of techno-rational thought was exposed in the last four national educational technology plans. If we acknowledge the progress already made in the field educational technology and extend the ideas and assumptions present in the NETPs, it becomes clear that technology in education will take an even more central role in our schools. As a result, it becomes important to have a way to critically engage in a productive discourse that can interact with the tensions between contrasting views regarding the nature of technology and reasonable alternatives to techno-rational thought. To that end, this chapter seeks to accomplish two things. First, demonstrate the relevance and process of engaging in a form of dialectical analysis with regard to three emerging educational technologies that are poised to make a significant impact in education in the next five years (New Media Consortium [NMC], 2011, 2012). Second, this chapter will outline four additional analytic and policy perspectives the field of education needs to consider in order to more fully understand the nature of technology in education.

Why is dialectical method so important to the conversation? If we hope to escape the limitations of techno-rational thinking, it stands to reason we would need an alternative tool of critique; one that is not focused on scientific evidence and mathematical calculation to make decisions. The need for a different tool, coupled with the fact that policymakers and practitioners need a means to weave together diverse perspectives, points to dialectical method as a framework or structure for more appropriately addressing the questions concerning technology in education.

As outlined in the opening quote, dialectical method is focused on inviting, "the juxtaposition of opposed or contradictory ideas, to interact with the tensions invoked by these contesting arguments, or to engage in the play of ideas" (Greene & Caracelli, 2003, p. 96). In regards to dialectical method, Marcuse argued "the classical model of dialectical thought may prepare the ground for an analysis of the contrasting features of technological rationality" (p. 124). He continued by saying that "dialectical thought understands the critical tension between 'is' and 'ought' first as an ontological condition, pertaining to the structure of Being itself" (p. 133). By using specific arguments or viewpoints as reference points, one is able to engage in a critical conversation between multiple views of technology. It is important to point out that this method is recursive, an ongoing reflective process.

For the sake of this investigation, the discussion will focus on three emerging technologies rather than technologies that are established in schools. Emerging technologies were chosen partly because there is already an established dialog surrounding many current technologies. While discussions around existing educational technology are certainly necessary and fruitful, they are often muddled with established perspectives and practice. Additionally, it is more difficult to disengage from current practice than to thoughtfully critique future directions. Several methods for disengaging from current practices are discussed later in this chapter; presently the examples used focused on emerging technologies.

Relevant examples of emerging educational technologies abound. In fact there are several organizations focused on researching and advocating on behalf of emerging technologies in education. Take the work of the New Media Consortium (NMC) as an example. The NMC is an advocacy and educational group focused on "identifying and describing emerging technologies likely to have a large impact on teaching, learning, research, or creative expression within education around the globe" (Johnson, Adams, & Cummins, 2012, p. i.). NMC describes itself as an international community of experts in educational technology with hundreds of member universities, colleges, museums, and educational organizations. In annual reports, NMC identified six technologies for K-12 education (2011) and six technologies for higher education (2012) that are most likely to make a significant impact on teaching and learning. Within each report they placed the technologies on a "time-to-adopt horizon" to help inform educational leaders understand what emerging technology have promise (Johnson et al., 2012, p. 6). Only three technologies made both the K-12 and higher education reports: learning analytics, game-based learning, and mobile learning. It is these three technologies that will serve as focal points for the analysis.

It is important to recognize that the merits of any specific technology are not what are salient to the discussion. To be clear, educational technologies are transitory, but the ways of engaging in meaningful discussion around them is what is relevant. The discussion of these three emerging educational technologies will be loosely informed by Taylor's and Marcuse's views in terms of the five themes identified in Chapter I: truth, human nature, relationship to society, nature of technology, and the aims of education. It is worth mentioning that these are certainly not the only perspectives policy makers and practitioners can use to engage in dialectical analysis. The method itself is flexible and accommodates a broad spectrum of perspectives. Several other possible perspectives will be explored later in the chapter.

Initially, Taylor and Marcuse would seem unlikely to engage in a conversation about technology. Separated by time, disciplines, and ideologies, these two thinkers seem to have little in common. Taylor for instance, had professional roots as a patternmaker and spent much of his time in manufacturing circles managing shops. Marcuse on the other hand, was an academic and philosopher who wrote much of his work nearly 50 years after Taylor's death. What could these two possibly have to say to one other about technology?

Given the analysis in the preceding chapters, they would have a great deal to say to each other about technology. Both were considered radical thinkers in their era, both were credited with being foundational to larger movements in their respective fields, but most importantly, they were both ultimately engaged in fundamental discussions about the nature and implications of modern technology. Returning to the fourth and final research question outlined in Chapter I, how do Taylor's (2011) and Marcuse's (1991) ideas and assumptions about technology compare when applied to emerging educational technologies? The primary aim for the following section is to compare and contrast Taylor and Marcuse in terms of their ways of thinking about the nature of technology given their historical, political, and economic contexts. Second, the discussion aims to incorporate specific emerging educational technologies to ground and elucidate the tension between their views. The analysis will utilize dialectical method as a framework for engagement with their ideas.

Learning Analytics

Broadly speaking, learning analytics joins a variety of data gathering tools and techniques to study student engagement and progress (Johnson et al., 2012, p. 7). As a student completes a series of lessons, his or her progress can be tracked and analyzed by teachers or experts in near real-time. The data collected can then be used to adjust lessons, teaching methods, and assessments for the student's benefit. Lessons are typically mediated by a computing device, be it a computer, student response system, or mobile phone. Given the investment in planning and implementation, learning analytics typically utilize large scale learning management systems (LMS) designed for teaching and learning. If the discussion begins with the proposition that learning analytics should be adopted and incorporated into teaching and learning, an interesting discussion ensues.

What About the Wealth of Information a Teacher Can Collect and Analyze Using Learning Analytics?

Taylor would emphatically agree with using learning analytics in education. In many respects, scientific management was an early iteration of this type of technique. What he and his disciples did with stopwatches on the factory floors can now occur in a variety of learning environments. Data collection happens in real-time, giving teachers access to timely information. Conceptually, learning analytics takes the guesswork and laxity out of teaching. In fact, for Taylor, all educational decisions should be grounded in observable and quantifiable data. With learning analytics, a teacher can know with precision exactly how a student is performing.

Marcuse would argue that the types of data collected through learning analytics should not drive educational decisions. At the very least, these types of systems serve to isolate and quantify students in increasingly abstract and harmful ways. Moreover, learning analytics is based on either explicit actions such as completing assignments or implicit actions such as social interaction, eye tracking, and time spent on course resources. These types of actions are reductionist in nature and cloud the bigger picture surrounding teaching and learning. Marcuse would further argue that other types of information exist, not just observable measurable facts. Students are not widgets in a factory, rather teaching and learning is a human endeavor that extends beyond facts and figures.

Does Learning Analytics Help with Teacher and Student Accountability?

Returning to the theme of eliminating guesswork and laxity, Taylor would argue that learning analytics is an exceptional tool for keeping both teachers and students accountable. These systems can track student and teacher progress over time and provide a very complete picture of achievement and mastery of predefined educational benchmarks. With these systems in place, schools can prevent students from falling behind and reward teachers that are doing exceptional work.

Marcuse would argue that the only thing learning analytics is good at measuring is the ability of students to perform specific tasks, not the spirit or intent of the task. The system encourages factual, isolated, formulaic information. In addition, the system is designed to analyze various isolated data points such as time spent on a resource or the number of postings to a discussion board. Systems that allow for learning analytics are poorly equipped to truly assess a student's progress, let alone a teacher's effectiveness. By its nature, learning analytics track all the information it technically can and in a sense treats all data as equal and relevant.

What About the Gains in Productivity and Efficiency?

Taylor would argue learning analytics could provide significant gains in a teacher's ability to more efficiently and effectively teach a larger number of students. If institutions leverage the full power of learning analytics, one could expect to teach a much larger number of students and only intervene in the instructional process when absolutely necessary.

Marcuse would argue that any gains in productivity and efficiency of the system come at the expense of the imposed limits on the types of knowledge the system encourages and discourages. It is limited to what can be quantified and measured. How can one measure human learning around empathy or creativity for instance? By their nature, the systems are too rigid and exclude alternative ways of understanding the world or demonstrating knowledge.

Does Learning Analytics Provide Information About a Student's Future Academic Performance?

Just as Taylor hoped to determine a personal coefficient for individuals to determine their proper class of work, learning analytics can provide predictive information about a pupil's performance based on various forms of statistical analysis. Given that these systems provide a data-rich snapshot of individual students as well as large populations of students, experts can build complete models of individuals and their likely educational outcomes. The systems are getting better at including more types of data and can predict with more accuracy future outcomes.

To reduce a person and his or her class in life to a series of statistical inferences would seem absurd for Marcuse. Rather than helping to illuminate a range of possible outcomes, it would limit individuals by defining them in terms of the system criteria. Marcuse stated:

> These requirements, as interpreted by the leadership which controls the apparatus, define what is right and wrong, true and false. They leave no time and no space for a discussion which would project disruptive alternatives. This language no longer lends itself to "discourse" at all, It pronounces and, by virtue of the power of the apparatus, establishes facts—it is self-validating enunciation. (1991, p. 101)

Marcuse argued systems that utilize learning analytics would perpetuate techno-rational way of thinking. It has no capacity to help encourage thoughts or ideas that are not part of the system. Think of the students that do not think in traditional ways or follow the normalized behaviors outlined in the system. Imagine if this type of thinking were to gain an even greater foothold in our world. How many great writers, artists, designers have been driven from their craft as a result of not performing well based a dataset of mouse clicks and test scores.

Game-Based Learning

Game-based learning is not a new concept in educational technology. Early game-based systems were often referred to as drill-and-practice software. These programs encouraged pupils to practice math problems or spelling words in a computer game environment. The students were rewarded with correct responses by collecting points or tokens in the game. What makes this current iteration unique is the notion of multi-player alternative reality systems. These are virtual-immersive worlds where students collaboratively complete specific tasks.

Are the Virtual Environments Possible in Game-Based Learning Powerful Learning Experiences for Students?

Certainly Taylor would show excitement with this development in educational technology. These systems allow students to learn and practice skills in virtual environments, work collaboratively, and practice skills in a safe environment. Once set up, game-based learning systems can be extremely productive and efficient for large-scale training. The widespread adoption of this modality in military training is one example. The authors of the Horizon report stated that “militaries worldwide have adopted games and simulations across the entire range of skills training they provide” (Johnson et al., 2012, p. 19). Certainly these gains in productivity and efficiency should be implemented in mainstream education.

For Marcuse, the problem extends beyond the productivity and efficiency of the system. Given the scale of these game-based virtual systems, it tends to standardize the experience for students. Moreover, the systems serve to better indoctrinate students into the techno-rational world. Even the best virtual world will still isolate and quantify reality in a way that further sheds any part of the experience that is considered meaningless by the system. Additionally, the experience is no longer under the ultimate control of teachers; rather the experts and designers have total control of the system. Simply stated, the consumers (teachers and students) are not in control. Their needs are dictated to them.

Does Game-Based Learning Motivate Students?

Just as he did in the factories, Taylor would argue that through scientific study researchers and designers could determine how frequently to reward students for correct behavior in order to keep them engaged in the learning activity. The entire system allows for tracking and quantifying student behaviors and interactions in such a way that they can be reinforced and reproduced.

Among other things, Marcuse would take issue with the idea that the correct outcome or success is predefined in game-based learning. These game-based virtual environments further remove individuals from reality and perpetuate one-dimensional thinking. Marcuse argued:

> Thus emerges a pattern of *one-dimensional thought and behavior* in which ideas, aspirations, and objectives that, by their content, transcend the established universe of discourse and action are either repelled or reduced to terms of this universe. They are redefined by the rationality of the given system and of its quantitative extension. (1991, p. 12)

The level of control and right action in the system would have been unheard of during his time.

Mobile Learning

Mobile learning encompasses mobile applications, smartphones, and tablet computers. The authors of the NMC report contend that these devices have become pervasive in the developed world and as a result there is a growing expectation that students should be able to learn on these devices anytime and anywhere (Johnson et al., 2012, p. 6).

Should Educational Institutions Leverage the Fact that Most People have Mobile Technology?

Mobile learning would present a number of exciting opportunities for Taylor. First, mobile learning utilizes a tool for educational purposes that students have already adopted. Second, these mobile tools are now more powerful than personal computers were a few years ago. When looking at delivery methods for education, it is an extremely cost effective tool.

Marcuse would argue that not all students have access to mobile learning devices. Additionally, this type of system furthers the divide between those who have access and those who do not. More importantly, it requires students to opt into a complex set of technological expectations. Mobile learning requires students to utilize the most current devices, to subscribe to a phone service, and to live and work in areas with high-speed internet access. Stated another way, mobile learning merely encourages the consumption of additional technological systems.

Does Mobile Technology Encourage a Variety of Educational Opportunities for Students and Teachers?

Taylor would argue mobile learning provides a variety of educational experiences for students. The applications utilized in mobile learning can span a wide range of modalities. They can be synchronous or asynchronous, collaborative or individual; the only limit is the creativity of the instructional designers. Mobile learning hardware includes the capabilities for two-way audio video conversations, video editing, web-research, simulations software, data collection, etc. Schools should be leveraging this new technological platform for teaching and learning.

One of the issues for Marcuse would be the fact that the technology mediates the entire learning experience for students. Students are driven to use the device as the only means for learning. It shapes their entire educational experience and it serves to define learning as what occurs through the device. Essentially only those things that can be captured or delivered by the device are the only valid educational experiences. The system encourages sound-bytes, short text-based responses, and limited reflection and thoughts. It literally compresses the experiences for the students into small technically manageable experiences. Marcuse commented that "the traditional stuff of art (images, harmonies, colors) re-appears only as 'quotes,' residues of past meaning in a context of refusal" (1991, p. 69). As such, the devices are by their nature poorly suited for meaningful teaching and learning.

Does Mobile Learning Allow for Anytime and Anywhere Learning?

Taylor would argue that mobile devices allow students to be more efficient and productive with their time. Students are no longer tethered to expensive classrooms or spaces with bulky computers. They can now be riding the bus or waiting for an appointment while working on course content. Essentially any free moments could be used to check-in and complete course tasks.

Marcuse would argue that mobile learning is a tool perfectly suited to further blurring the line between an individual's school, work, and private time. Just as the cycle of production and consumption feeds on itself, mobile learning does not allow the student to escape the ever-present call of the system. Marcuse argued,

> Today this private space has been invaded and whittled down by technological reality. Mass production and mass distribution claim the entire individual, and

> industrial psychology has long since ceased to be confined to the factory. The manifold processes of introjection seem to be ossified in almost mechanical reactions. The result is, not adjustment but mimesis: an immediate identification of the individual with his society and, through it, with the society as a whole. (1991, p. 10)

By their nature, mobile learning systems are designed to bombard the student with updates and alerts that require the student's attention and action. What would traditionally happen for a fixed amount of time in a classroom setting is now spread throughout the entire day. Furthermore, Marcuse stated that "solitude, the very condition which sustained the individual against and beyond his society, has become technically impossible" (1991, p. 71). A walk in the forest can now be interrupted by a message from the system about a recent course announcement. Furthermore, this type of socialization reinforces the intrusion of work life into the personal world. Mobile learning conditions individuals to be responsive anytime and anywhere to messages from the system. Vacations and getaways are merely a change in scenery, not a disengagement from the system.

The primary goal of this section was to utilize dialectical method to compare and contrast Taylor and Marcuse in terms of their ways of thinking about the nature of technology. A secondary goal was to utilize specific emerging educational technologies to ground that comparison. As outlined in the opening quote, dialectical method was utilized and invites "the juxtaposition of opposed or contradictory ideas, to interact with the tensions invoked by these contesting arguments, or to engage in the play of ideas" (Greene & Caracelli, 2003, p. 96). To reiterate, this method is recursive, an ongoing reflective process. Additionally, the merits of any specific technology are not what are significant; rather the ways of engaging in meaningful discussion around them is what is relevant.

Ideas to Better Engage the Field of Educational Technology

Returning to Goodman's quote, "Whether or not it draws on new scientific research, technology is a branch of moral philosophy, not of science" (1970, p. 40). His aim was to extend the conversation about technology beyond the techno-rational thought that currently frames it. At this point, it should be more clear to the reader why questions surrounding technology need to occur outside the realm of science. As Marcuse stated,

> Observation and experiment, the methodical organization and coordination of data, propositions, and conclusions never proceed in an unstructured, neutral, theoretical space. The project of cognition involves operations on objects, or abstractions from objects which occur in a given universe of discourse and action. Science observes, calculates, and theorizes from a position in this universe. (Marcuse, 1991, p. 157)

If Marcuse was correct, that techno-rational thought is not neutral but comes from a biased theoretical space, then policymakers and practitioners must develop a means to critically engage technology and the techno-rational worldview. The remainder of this chapter identifies four additional ways for policymakers and practitioners to critically engage with techno-rational thought and the nature of technology.

Policy Content Analysis

As demonstrated in Chapter IV, interrogating policy helped expose the legacies of techno-rational thinking in the last four NETP (USDOE, 1996, 2000b, 2004, 2010) by placing them under the same type of critically oriented content analysis utilized in chapters two and three. The analysis focused on a summary of the content analysis based on the five themes of analysis outlined in chapter one; truth, human nature, role in society, nature of technology, and aims of education. The analysis of the four technology plans was meant to be illustrative, not exhaustive. This method could be employed at the federal, state, or district, level to critically analyze existing and draft policies to reveal hidden biases and perspectives that may have gone otherwise unnoticed.

Contributions from Critically Oriented Theories

Clearly there is a place for philosophy of technology, critically oriented theories, and contributions from a wide range of fields that can speak to technology in education. Leadership in educational technology needs to begin to more fully acknowledge other fields and break away from one-dimensional thinking in order to more fully understand the greater impact of technology in our schools and our society. One way this this can be achieved is by exploring various critical perspectives and their connections to educational technology. Ultimately, these perspectives can open a more critical dialog in the field and serve to radically shift the discourse.

As outlined in Chapter I, there is little recent discourse with regard to critically oriented perspectives in educational technology. This has not been the case in educational administration. As early as the 1950s and 1960s, many scholars began to question scientific management's guiding principles of rationality and objectivity in educational administration (Starratt, 2003). As a result of these early objections, many contemporary educational leadership scholars critically analyzed the principles of scientific management in favor of other models and as a result, the field has experienced several major shifts away from scientific management and toward principles of social justice (Marshall & Parker, 2006), transformative leadership (Dantley & Tilllman, 2006), and critical theory (Capper, 1998; Foster, 1982; Gibson, 1986).

While much of the current discourse in educational leadership is focused on critical theory, it is important to note that there is not a unified critical theory, but rather a collection of theories that share a common origin (Gibson, 1986). In addition to critical theory, feminist theories, critical environmental theories, and critical pedagogy, all contribute to what Capper (1998) described as critically oriented theories. These critically oriented theories offer unique perspectives through which practitioners and policy makers can frame conversations about technology in education.

Traditional critical theory is primarily interested in social change to emancipate those that are oppressed. As a result, traditional critical theorists tends to focus on the historical, political, economic, and social context (Starratt, 1993) and tend to utilize rational, intellectual dialogue to analyze problems of practice (Capper, 1998). These discussions serve to identify power structures that dominate and oppress. There are several important themes that surface when educational technology is viewed through the lens of critical theory. Particularly issues of whose economic interest is served when computers are integrated into schooling and in what ways does technology serve to oppress people and groups.

Another relevant critically oriented theory is feminist theory. Unlike critical theory, feminist perspectives do not focus so much on scientific rationality and intellect, but rather focus on intuition, emotion, experience, and relational understanding over moral reasoning (Capper, 1998). Feminist theories tend to build on traditional critical theory and emphasize gender. Unfortunately, feminist perspectives are often overlooked in conversations about technology in schools (Damarin, 1994; Sofia, 1998). Sadker and Sadker (1994) argued that “gender lines guarding male domains—mathematics, science, computer technology, athletics, and vocational education—are vanishing, but harmful remnants remain” (p. 121). Conversations about how technology affects gender inequalities are critical given the nearly ubiquitous presence of technology in learning and teaching.

Other critically oriented theories such as critical environmental theory (Bowers, 1988, 1995, 2000; Merchant, 1994), critical race theory (Delgado & Stefancic, 2001; Taylor, Gillborn, & Ladson-Billings, 2009) and critical pedagogy (Kincheloe, 2004, 2008), could also serve to inform educational technology policy and practice. Simply stated, normative behavior and cultural rituals are often deeply imbedded into technology. Therefore significant contact with fields that critically analyze those normative behaviors and cultural rituals is necessary to understand how they are reified through educational technology. In their critique of instructional technology, Johnsen and Taylor argued:

> Instruction and instructional technology are human inventions that spring from human values and human designs. They are value-saturated and operate in the social world . . . social inventions . . . are never value-free or value-neutral. They resonate with the values of their human creators, who themselves are situated in a particular culture in a specific time and place. (1995, p. 94)

Additionally, the work of other critically oriented theorists that transcend the categories mentioned above should be investigated and explored by educational technologists. The work of Foucault (1965, 1972, 1977), Freire (1970, 1998), and others has the potential to address different aspects of educational technology in schools.

The following list is an attempt to bring together a thoughtful sampling of the many questions critically oriented theories ask, all with the hope of challenging the traditional ways of thinking about technology in schools. Many of these questions were shaped by the work of Capper (1998) and her summary of critically oriented perspectives and their application to educational leadership.

- What historical, political, economic, and social contexts have brought us to this point?
- Whose economic interests are being served when computers are integrated into schools?
- What attitudes, values, and behaviors are at work?
- Who benefits? Who does not?
- How does technology produce and reproduce gender differences and gender inequalities?
- How is a culture of domination over the natural world reflected in policies and practices surround educational technology?
- How does technology misrecognize, misrepresent, neglect, deny or undervalue the social contributions and culture experiences of girls and women?
- How does technology interfere and subvert ways of knowing based on intuition and emotion?
- How is culture manifested in various forms of technology?

- How does technology misrecognize, misrepresent, neglect, deny or undervalue the social contributions and culture experiences of various ethnic groups?

Luddism as Epistemology

Another approach for critically analyzing technology was originally put forward by Winner (1987). His notion of Luddism as epistemology was a response to what he called the “tentative steps in uncertain directions” put forth by many philosophers of technology (Winner, 1987, p. 326). To that point, even Marcuse’s (1991) notion of the great refusal, which called for radical and systemic change, leaves the reader with many important questions about how to thoughtfully proceed. Recognizing the limitations of much of the work surrounding the nature of technology, Winner (1987) envisioned a more concrete and achievable approach. What he advocated for was a thoughtful, focused rejection of the technology with the expressed purpose of learning from that disengagement.

Briefly, the Luddites were a social movement that originated in England during the nineteenth century. The movement was a direct response to mechanization of the looming process during the industrial revolution (Sale, 1995). The Luddites became notorious for breaking into textile factories and destroying the mechanized looms they felt produced an inferior product and robbed them of skilled jobs. While Winner (1987) did not advocate for violent unrest, he did argue for a thoughtful undoing of technical systems with the aim of gaining knowledge and understanding around how those systems were woven into our world.

It seems reasonable that this approach could be more easily applied to technological systems in education than say Marcuse's great refusal (1991) as outlined in Chapter III. In other words, the thoughtful dismantling of technological systems in education could provide researchers, stakeholders, policy makers, and practitioners a better way to assess technologies impact on teaching and learning. At the end of his text *Autonomous Technology,* Winner envisioned a world where,

> Technologies identified as problematic would be taken apart with the expressed aim of studying their interconnections and their relationships to human need. Prominent structures of apparatus, technique, and organization would be, temporarily at least, disconnected and made unworkable in order to provide the opportunity to learn what they are doing for or to mankind. (1987, p. 330)

He continued by arguing that institutions continued to upgrade and replace systems as a matter of course. Here again, Winner (1987) felt there could be an opportunity to research the void left by technology that is not replaced or upgraded. Rather than buying new laptops or investing in more elaborate online course management systems, educational institutions could systematically disengage from the technology as a type of educational experiment. Winner continued, stating that "the idea is that in certain instances it may be useful to dismantle or unplug a technological system in order to create the space and opportunity for learning" (1987, p. 331).

One principal aspect of current research in educational technology is the focus on seeking examples where technology is a productive and efficient tool for teaching and learning. This focus is coupled with both the belief in the power of technology and a belief in the progress that is associated with technological evolution. Given that important critical questions remain concerning technology in education (Blacker, 1994; Bowers 1988, 2000; Bromley & Apple, 1998; Postman, 1993, 1995), it would seem reasonable to spend an equal amount of time exploring the positive effects of disengagement from technology in education.

Moral Agents

How can these goals be accomplished? As Feenberg (1991) argued, the instrumental view of technology is the most widely accepted view of technology. This view assumes that technology is value neutral. In addition, Kanigel (1997) argued this way of thinking "so permeates the soil of modern life we no longer realize it's there" (p. 7). The preceding chapters argued there are alternative ways of understanding the nature of technology and its impact on our world and our patterns of thought (Marcuse, 1991).

It is important to reiterate that while all four NETPs reflected the language and assumptions surrounding techno-rational thinking, none of the plans formally acknowledged that dominance as primary motivator for their goals around technology in education. Furthermore, none of the NETPs offered any space to critically oriented perspectives. Rather, considerable effort was spent convincing the reader that educators and policymakers "must apply the advanced technology available in our daily lives to student learning and to our entire education system" (USDOE, 2010, p. 3). This one-dimensional thinking is a direct reflection of the teams that authored the NETPs. Each of the four plans was authored chiefly by teams of educational technology experts, technology manufactures, business leaders, and educational policy makers. While each plan argued that it engaged in broad-ranging discussions (USDOE, 1996), in consultation with the full range of stakeholders (USDOE, 2000) and provided for an “inclusive process . . . [that] enabled tens of thousands of individuals to learn about and contribute to the development of the plan” (USDOE, 2010, p. xv), there was no evidence that any individuals trained in the philosophy of technology or familiar with critically oriented views of the nature of technology aided in the writing or researching the plans.

Unfortunately, simply training educational technologists in critically oriented perspectives will not be enough to fully unpack the issues related to technology in education. It is certainly a worthwhile endeavor and, at the very least, it will help practitioners understand the importance of engaging with alternative perspectives as well as acknowledging the underling motivations that drive the need for more technology, greater efficacy and improved productivity in schools.

In order to more appropriately frame policy creation and academic research surrounding technology in education, it will require the presence of individuals that are not technologists and are conversant in the methods and discourse surrounding critically oriented theories. The reason this is necessary is actually simple: Technology experts are inescapably immersed in the very type of thinking that it is necessary to depart from in order to frame logical critical alternatives. As a result, technology experts are poorly equipped to respond critically. Ellul (1964) made this argument when he commented:

> A principal characteristic of technique . . . is its refusal to tolerate moral judgments. It is absolutely independent of them and eliminates them from its domain. Technique never observes the distinction between moral and immoral use. It tends on the contrary, to create a completely independent technical morality . . . It does not perceive technique's rigorous autonomy with respect to

> morals; it does not see that the infusion of some more or less vague sentiment of human welfare cannot alter it. Not even the moral conversion of the technicians could make a difference. At best, they would cease to be good technicians. (p. 97)

Educational technologists are modern technicians and operate in this independent technical morality. This is demonstrated in how the history of the field is framed (Reiser 2001; Saettler 1990) and the ways educational technology is thought of as a technological endeavor rather than an educational one (Heinich, 1984). Historically speaking educational technology has always had close ties to the techno-rational worldview. From radio to motion pictures to modern computer technology, various forms of technology have been seen as a way of educating more people more efficiently.

Prior to modern computer technology, the discipline was focused primarily on instructional media. Classroom tools like filmstrips, records, and motion pictures were the emphasis of the field. An important defining moment in the field was the emergence of modern computer technologies. These new technologies required more coordination, planning and support in order to make them effective classroom tools. This often caused confusion about who was responsible for supporting the technology. Was it now the classroom teacher's responsibility? Did it fall to the library or media staff? By the late 1970s and early 1980s the discipline was at a crossroads, ready to shed its roots and break away from its traditional limitations.

At this early stage of redefining the field, several scholars advocated for new ways of thinking about the emerging field of educational technology. Heinich (1984), one of the most influential and controversial scholars, argued for a paradigm that explicitly returned to the theoretical core of the discipline. In many ways, he felt the discipline was unduly influenced by education and would be better off left to technical experts rather than educators. In a ground-breaking essay Heinich argued that “to be radical is to grasp the root. The root of instructional technology is technology itself. Instructional technology as a field of study is better considered as a subset of technology in general rather than a subset of Education,” (1984, p. 67). Here Heinich made explicit the technological imperative and argued for shedding that which hinders progress in order to focus solely on technology.

In a later essay, Heinich (1984) made the connection to the techno-rational worldview more explicit. He stated: “A technology survives because of faith, continuing internal improvement, an institutional structure that encourages and facilitates continued development, and an environment that permits a new technology to seek the best avenues for its contribution,” (1984, p. 22). On several levels, this statement resonates with Taylor’s (2011) beliefs about scientific management. Faith in the technology, internal improvement by experts, and an accepting atmosphere were all critically important to scientific management and Heinich argued they were also critically important to educational technology. In many ways this grounding in the techno-rational worldview served as what Blacker (1994) referred to as the normative core of educational technology theory.

Even more recently, these views were represented in popular books on educational reform. For example, in his book *School's out: Hyperlearning, the new technology, and the end of education*, Perelman (1992), former director of Project Learning 2000 and a Senior Fellow of the Discovery Institute stated: “Technology is the most purely human of humanity’s features, and it is the driving force of human society,”

(p. 25). He went on to argue that schools should abandon the old models of teaching and learning entirely in favor of new technological systems. Perelman (1992) believed we could no longer rely on reforming the old system because "the nations that stop trying to 'reform' their education and training institutions and choose instead to totally replace them with a brand-new, high-tech learning system will be the world's economic powerhouses through the twenty-first century," (1992, p. 25). Clearly these thinkers view educational technology operating within an independent technical morality.

As Marcuse (1991) argued, this type of thinking is one-dimensional and cannot accommodate rational alternatives. In order to effectively assess technology and its impact in schools, it is necessary to include and give reasonable priority to those that are trained in critically analyzing the interplay of the nature of technology and education.

As mentioned above, the inclusion of critical perspectives has already begun in educational leadership. While educational leadership has experienced these foundational shifts away from scientific management, leadership in educational technology has not yet had the same level of acknowledgment of critical alternatives. This is not to say that there have not been vocal critics. To be clear, not all educational technology scholars and practitioners fully endorse the techno-rational worldview. For instance, Hlynka (1992) advocated for a postmodern paradigm of educational technology. This postmodern view included a critique of the impact of the techno-rational worldview in the field. Another scholar, Bowers (1998), explicitly argued that technology is non-neutral and therefore must be interrogated in practice. Other scholars have also provided fertile ground for a critically oriented critique of educational technology (Cuban, 2001; Postman, 1995). Despite the calls from these scholars, many instructional technologists and policy makers do not adequately question the underlying values and power structures of technology (Bromley & Apple, 1998). It is to say that much of what occurs in leadership in educational technology is still linked in large part to the principles of scientific management and the techno-rational worldview.

What is needed extends beyond simply training educational technologists in critical perspectives or relying on the few educational leaders that are well versed in critical perspectives. What is needed are dedicated moral agents and philosophers of technology serving in an official capacity. These individuals would be better positioned to provide meaningful critic and educate policy makers in better understanding these critical perspectives.

The notion of an institutional moral agent is not a new one. Medical research has been required to maintain institutional entities to critically analyze intuitional policies, practices, and initiatives in the form of institutional review boards since 1966 (Gray, 1982) in an attempt to ensure medical scientists consider the rights of patients. Moral agents seek to answer questions that scientists are poorly equipped or positioned to answer. In the context of educational technology, moral agents would be able to shift the discourse and research from questions centered on what can be gained by integrating technology into education to what harm might be done by integrating technology into education. This shift in thinking allows for multi-dimensional thinking and begins the dialectical analysis that Marcuse (1991) called for in his text.

Conclusion

As Goodman (1970) argued, technology is ultimately a moral problem rather than a scientific one. The ways in which educational technology is currently framed, effectiveness assessed, and judgments made about its potential, are grounded in science. Marcuse (1991) argued that science observes, calculates, and theorizes from a particular biased position. Part of this bias excludes alternative ways of thinking and results in one-dimensional thinking. As a result, essential reference points such as the origins of the educational technology, the nature of technology, and alternative critical frameworks are often excluded. Without these alternatives, the field of educational technology has been largely confined to one-dimensional thinking around issues of technology in education.

Over time, this one-dimensional thinking in educational technology has become normative, considered appropriate, and in accordance with best practice. To escape its influence takes radically different ways of thinking about the history, aims, and assumptions of technology in education. Only then can it be hoped that tensions between current thinking and potential alternatives will be revealed.

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