

Chapter 13

E-Leadership and Teacher Development Using ICT

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Abstract In this chapter, we develop a definition of e-leadership that extends from the business sector to encompass educational contexts. We describe schools as complex ecologies and dynamic organizations that require a change in both traditional forms of leadership and more recent ICT use. We use the RAT (Replace, Amplify, Transform) framework to explain the varying degrees to which ICT has been used in business and education and relate this model to the research in e-leadership. It is through the purposeful, transformational use of ICT and the meaningful development of multiple kinds of knowledge that those in charge of teacher education and growth can use ICT to develop a new kind of teacher leader.

Keywords E-Leadership · Leadership · Teacher development · ICT · Teacher education school ecology · Systems change · Technology integration

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13.1 E-Leadership and Teacher Development Using ICT

Internet and Communication Technologies (ICTs) have transformed many aspects of the way we work and live today. It has been argued that the integration of new technological tools has the potential to change how organizations function and the nature of leadership required in these changing settings. Schools as knowledge industries are often seen as being an important context for such changes. In this chapter, we explore the idea of e-leadership within the context of schools and teacher development.

We begin by outlining the overall structure of the argument we present. Following a brief introduction and overview of existing work on e-leadership (much of which has been in the domain of business), we develop a definition of e-leadership that would apply to educational contexts as well. We note that current work on organizations has indicated that the effects of technology upon organizations is not determined by the technology itself, but rather that it occurs within a reciprocal relationship between the technology and the organization (in terms of its culture, structure, approach, context and more). To better understand this nonlinear, nondeterministic, and reciprocal process of technology infusion, we offer the metaphor of organizations as complex ecologies. This perspective on organizations allows us to work with three different ways in which technology can influence and change leadership—via replacement, amplification, and transformation. The Replacement, Amplification, and Transformation (or RAT) model has been utilized in terms of technology integration in classrooms in the past, and we suggest it can apply to models of e-leadership. We explain each of these components and provide examples from the world of business and education. Finally, we investigate the consequences of this approach for teacher education and teacher professional development.

13.1.1 Introduction

Early works on e-leadership, often originating from the business and management sphere, tended to paint the rapid rise of technology-enabled work environments in rosy colors. Technology, as these works would have it, could offer institutions a veritable panacea for workplace challenges: Employees from all over the world would be able to communicate, collaborate, and telecommute. Productivity would soar, and complex tasks would soon be completed with astonishing efficiency. Leaders would be able to effortlessly monitor the status of employees and their projects. Yet accompanying these sanguine visions of the future were calls for a more critical examination of the relationship between leadership and technology.

Today, there seems to be general agreement in the literature that established perspectives on leadership (such as authentic leadership, transformational leadership, and servant leadership) still offer value and relevance. In other words, the

introduction of ICT into an organization and its work practices can lead to changes, but the processes are not as linear and the effects are not as deterministic as described in some of the literature. For example, it is well established that leaders play a crucial role in team performance by modeling teamwork and setting expectations (Cascio and Shurygailo 2003). However, traditional approaches do not necessarily or automatically transfer to newer, technology-enabled environments (Gurr 2006; Kahai and Avolio 2004). So long-established theories of leadership may be necessary, but not sufficient, for successful leadership in ICT-mediated environments.

Avolio et al. (2014) see a transformational potential in what technology can do to and for human society, but believe that our understanding of how technology is implemented in organizations and the impact on how people collaborate and work is limited because the topic has not been explored fully. Avolio et al. (2000) argued that ICT creates a new context for leadership that results in a co-evolution of technology and leadership—these two components work together, influence each other, and are connected within the organizational context. Technology, they argue, is changing organizations and the very definition of leadership (Avolio et al. 2014). Gurr (2004) came to the same conclusion, stating that ICT and leadership have a reciprocal relationship with each impacting the other as change occurs.

One of the challenges of thinking about e-leadership in education is that a significant portion of the literature on the topic has focused on business or corporate settings, with relatively little attention paid to what these ideas mean for schools and other educational contexts. This is not to say that these ideas of e-leadership do not have implications for education and teachers, but that the contexts are different, the existing literature is limited, and we need to be careful in how these ideas are conceptualized, based on context. In the next section, we provide a definition of e-leadership that is broad enough for both business/management as well as educational contexts.

13.2 Defining E-Leadership

Starting from a business and management perspective, Avolio et al. (2000) defined e-leadership as a social influence process mediated by technology (which they refer to as Advanced Information Technology, or AIT):

E-leadership is defined as a social influence process mediated by AIT to produce a change in attitudes, feelings, thinking, behavior, and/or performance with individuals, groups, and/or organizations. E-leadership can occur at any hierarchical level in an organization and can involve one-to-one and one-to-many interactions within and across large units and organizations. It may be associated with one individual or shared by several individuals as its locus changes over time (Avolio et al. 2000, p. 617).

Kahai and Avolio (2004) modified this definition slightly, referring to information technology in a more general sense and elaborating on the social, cognitive, and behavioral ramifications of leadership:

In this entry, e-leadership is defined as a process of social influence that takes place in an organizational context where a significant amount of work, including communication, is supported by IT. That process of social influence is aimed at producing a change in attitudes, emotions, thinking, behavior, or performance (p. 418).

More recently, Avolio et al. (2014) offered an updated definition that reaches beyond the field of business and describes e-leadership as “a social influence process embedded in both proximal and distal contexts mediated by AIT that can produce a change in attitudes, feelings, thinking, behavior, and performance” (p. 107). The broadness of this definition lends itself to educational settings as well.

Conceptualizing e-leadership as a “social influence process” emphasizes the social elements of any organization. In other words, ICTs are an important component of e-leadership but are situated within the larger social context of the organization—a social context that can also relate to how any leadership is approached and enacted. Again, we see that the relationship between an organizational context, and the different elements of leadership and technology within that organization, are complex and interconnected. They are affected by each other and by aspects of the organization as a whole.

We suggest then, that one of the important challenges to understand in this regard is that organizations are complex and the effects of new technologies are not necessarily predetermined. The culture of the organization can often distort, undermine, enhance, or otherwise affect the role of technology. As Kentaro Toyama (2015) in his recent book *Geek Heresy* suggests, technology often acts as an amplifier of social conditions—having the potential to enhance both the positive and the negative. Thus, if we have to develop a nuanced understanding of the role of ICT and leadership in educational settings, we need a new way of thinking about organizations and organizational change and leadership.

13.2.1 Rethinking Organizations and Their Metaphors

There are various metaphors that we can use to think about organizations. Metaphors do not just shape our communication, they also shape the way we think and act (Lakoff and Johnson 1980). As Gareth Morgan (1997) writes in his book *Images of Organization*,

All theories of organization and management are based on implicit images or metaphors that persuade us to see, understand, and imagine situations in partial ways. Metaphors create insight. But they also distort. They have strengths. But they also have limitations. In creating ways of seeing, they create ways of *not* seeing. Hence there can be no single theory or metaphor that gives us an all-purpose point of view. There can be no “correct theory” for structuring everything we do (Morgan 1997, p. 348).

For instance, viewing an organization as being akin to a *machine* provides certain ways of thinking about the role of individuals and leaders within the organization. It is not surprising, given the ubiquitous nature of this metaphor, that when things are going well, we speak of organizations that “run like clockwork,” or like a “well-oiled machine,” and in contrast, when things are not going well, we speak of “breakdowns” or “things that need fixing.” Along the same lines, we speak of organizations as having “inputs and outputs,” which we seek to “maximize” and make “efficient.” People in this framework, become “cogs in a wheel” or human “resources.” Morgan (1997) argues that this mechanical way of thinking is deeply “ingrained in our everyday conception of organizations” (p. 6), and that it is almost impossible to think of organizations in new and, possibly more useful, ways.

In the next section, we provide one way of looking at organizations as being *complex ecologies* and suggest that in using this metaphor, we afford ourselves a richer and more provocative way of thinking about organizations, organizational change, and e-leadership. The ecological metaphor prevents us from merely seeing simple cause–effect relationships between the introduction of new technologies and their effects on organizations.

13.2.2 Understanding the Ecological Metaphor

Though we argue in favor of an ecological metaphor that has rich potential as a metaphor for thinking about organizations as complex ecologies, we must also note that the broader aspects of this framework are not original to us. As Zhao and Frank (2003) write:

Viewing human institutions as ecosystems is not new. Bronfenbrenner (1979, 1995), Bronfenbrenner and Ceci (1994) and Bronfenbrenner and Morris (1998) has long been a champion in developing theories and conducting research about human development from an ecological perspective. Lemke (1994) uses the term “ecosocial system” in his application of the ecological approach to the study of cultural change. Bruce and Hogan (1998) analyzed technology and literacy from an ecological perspective. Nardi and O’Day (1999) refer to settings where technology is used as “information ecologies,” which are systems “of people, practices, values, and technologies in a particular local environment.” (p. 49).

In an ecological system, a point called “homeostasis” is achieved once there is a kind of balance or stability achieved by the different elements in a complex system that exist in state of a dynamic tension. The introduction of a new element, environmental factor, or species into the system can have different types of effects which are difficult to predict. The way that the system self-regulates to achieve a kind of stability or balance is indicative of the elements within the system and how they operate—particularly in relation to the new variable. So in this e-leadership metaphor, the introduction of ICTs becomes an essential element or variable added to the system, which it may deal with in various ways and with different results.

In the e-leadership literature, this type of view is described by Avolio et al. (2000) in terms of a socio-technical systems approach. Within this framework, the

effectiveness of an organization is determined by the amount of alignment between social systems, technical systems, and the external environment. Thus, technologies and the social systems in which they are used are not simply correlative; in fact, they both influence and are influenced by each other in a reciprocal relationship. Leadership would clearly be impacted by this relationship, since it is a key element in the social systems and structures of organizations.

This new ecological approach toward organizations reconfigures the relationship between technology and leadership. A first step in this direction can be seen in the Avolio et al. (2000) proposal of a modified version of DeSanctis & Poole's Adaptive Structuration Theory (AST) framework. The original purpose of AST was to investigate and explain how people integrate technology into their work and was based on the idea that human action is guided by rules and resources (structures) that serve as models for the planning and completion of tasks. In this view, the effects of technology develop through interactions with organizational structures in which leadership plays a role; furthermore, the organizational structures themselves can be transformed by their interactions with technology. That is, not only can technology change as a result of the context in which it is used, but it also has the ability to influence that context in return. Therefore, it is critical that e-leadership be studied in context, as "in the case of e-leadership the context not only matters, it is a part of the construct being studied" (Avolio et al. 2000, p. 616). In the next section, we seek to better understand the *context* within which schools function.

13.3 The Educational Context and E-Leadership

The idea of leadership is contextually bound to the kinds of organizations being discussed. The goals of leadership in the corporate world are different than those of leadership in the nonprofit world or in the world of education. It is no surprise, therefore, that the idea of e-leadership will play out differently in education than in other organizations. Thus it is important to understand that schools both are and exist within a *complex socio-technological ecology*. We suggest that seeing schools as a complex ecology provides us with a sophisticated way of thinking that values the reality and organic nature of the organization, as well as the diverse interests of the various stakeholders in the process.

The ecological metaphor implies that rather than studying discrete factors seemingly acting independently of each other, we see schools as organic and dynamic structures, with complex nonlinear feedback loops, that defy easy predictability and control. In this view, schools are knowledge industries that are a complex system of many parts and relationships, incorporating both human actors (such as teachers, students, parents, administrators etc.) and nonhuman actors (e.g., physical settings, technologies such as computers and networks, curricula, subjects of teaching). These actors form a complex system where they interact with each other, in ways that continuously modify their relationships with each other, as they attempt to strike a stability and balance—their own "homeostasis" if you will.

Schools, of course, do not exist in isolation from the rest of the world. They are nested within hierarchies—for instance, school districts, which in turn exists within broader state and national educational systems. Teachers once again are a key component of this ecology—as they can function as gatekeepers to change or as agents of change and transformation.

Thus, understanding how ICTs influence and change the nature of leadership and teacher development requires a comprehensive and systemic approach that takes into consideration the nature of the actors, the environment, other facilitative forces, and the interactions among these components. This means that the introduction of ICTs into an organization such as a school does not lead to simple predictive and predictable effects. The complexity of an ecological system often works against such simple input-output models of cause and effect.

It follows from this perspective that the internal system of an organization or group—including institutional culture, levels of expertise, shared mental models, and the social interactions of its members—exerts a strong influence on any technologies to be used within it. Users frequently reject, resist, or adapt technologies in ways that go beyond their intended use, resulting in unexpected consequences. Since leadership plays a central role in guiding the internal systems of a group, it is particularly relevant to the emergent interplay between organizational structures and the technology integrated within them. That is, leadership can influence the social structures of an organization in ways that foster or hinder the implementation of technology.

Taking on an ecological framework helps us to push away from simplistic, deterministic, and linear approaches to thinking about technology and its role in educational contexts. Despite seemingly straightforward definitions, the conceptual understandings and resulting empirical study of e-leadership have been fairly inconsistent. Gurr (2004) identified three major categories/views of e-leadership that have sparked three different streams of research: “More of the Same,” “Leadership Plus,” and “Transformation” (pp. 116–117).

In keeping with existing research in educational technology integration, we suggest that this fits well with the *Replacement, Amplification, and Transformation* (or RAT) framework (Hughes et al. 2006) for thinking about ICT and leadership. We are careful to emphasize that while this three-fold categorization provides us with ways of thinking about how e-leadership can unfold, it is never a deterministic or predictive model. Once a technological variable (or multiple such variables, or ICTs) is introduced to a system, the results will depend on unique and dynamic systemic factors of the organizations or schools themselves. However, as such systems react dynamically to the element of ICT, and try to achieve a balance (or homeostasis) within the organization/school ecology, we suggest that the Replacement, Amplification, and Transformation model gives us three broad possible categories to understand how this can often play out.

13.3.1 Replacement, Amplification, and Transformation

The RAT framework emerged from scholarship that sought to better understand the manner in which teachers integrate technology in their teaching. Hughes et al. (2006) define three categories of teachers' integration of classroom technology, including: (a) Technology as Replacement; (b) Technology as Amplification; and (c) Technology as Transformation. Perhaps unsurprisingly, technology as "Replacement" refers to using technology to simply replace existing instructional tools. It is the most basic level of technology integration, in that there are no pedagogical changes. The new tool is simply swapped into the place of the old tool. However, technology as "Amplification" refers to using technology that somehow enhances or amplifies existing teaching practice and student learning. At this level, dramatic enhancement of learning does not necessarily happen, but in taking advantage of augmented technology affordances, digital tools are used to increase efficiency and productivity. However, at the technology as "Transformation" level, such tools are used in ways that fully and fundamentally alter (or transform) the pedagogy, how students learn, and perhaps even the subject matter. In this transformational place, the role of technology changes the teaching itself, the instructional methods, the work or role of the teacher, the learning process, and/or possibly the content.

We see a reasonably straightforward mapping of the RAT framework to that of e-leadership. Replacement involves a simple substitution of the new technology tool for the existing tool or method. Nothing is improved, as it is at best a neutral swap (or at worst a retrograde). Amplification does alter things to a degree, in offering some enhancement or improvement through technology use that allows something to be done better than before. Things do not change vividly though, until applying technology at the transformational level. This indicates an application that is not only fundamentally different from existing instruction, but in which the affordances of the technology, and its use, allow for a total reshaping of the variables in the situation—of how the teacher teaches, of what and how students learn, and even of the ideas in play. In the next section, we focus on each of these constructs in greater detail, in exploring and mapping them into an e-leadership model. By aligning these views with the RAT framework, we begin to discern a picture of the research that has been conducted, and the need for future investigation in the field. In each case, we look at it from the literature of business and management (given the preponderance of work in these domains) and then its consequences within educational contexts.

13.3.2 Replacement or "More of the Same"

In business. The first view stems from the business sector, and involves simply transferring traditional views of leadership to modern organizations, relabeling

them as e-leadership—traditional ideas, with a contemporary name. This view has led to considerable conceptual confusion by using this new name only to refer to “more of the same” (Gurr 2004, p. 116). As in the description of replacement in the context of using technology, this “more of the same” view of e-leadership refers to simply replacing the label of leadership with e-leadership. There are no changes to the concept or the kinds of leadership behaviors that may be needed even though the environment (or organizational ecology) has changed significantly with the introduction of ICT.

In education. Within educational contexts, the “Replacement” model suggests a similar point of view, i.e., ICTs though introduced are often used for basic purposes that have been previously defined and are thus constrained by existing practices. Technologies are used to replace existing mechanisms. In the school context, this can be seen in the introduction of attendance systems, the use of spreadsheets for budget calculations, or classroom websites to share homework problems with students. In each of these cases, there has been no fundamental change in the administrative or pedagogical processes that existed before—apart from the fact that they have been replaced by ICTs. If we think of schools as a complex ecology, the replacement approach suggests the replacing of a key species with another—with no or little change to the overall ecological balance of the environment. Technologies that align well with existing practices get accepted faster than ones that may disrupt or change existing approaches. An example of this is the quick incorporation of PowerPoint or the under-utilization of smart-boards in the classroom context. In both cases, these technologies merely replace existing practices (the lecture mode) without causing any real change to teaching and learning.

In contrast, other researchers have argued leadership in ICT environments requires different skills (Gurr 2004). This leads us to a second view of e-leadership.

13.3.3 Amplification or “Leadership Plus”

In business. The second, what might be described as “leadership plus” (Gurr 2004, p. 117), builds upon traditional approaches to leadership, and is based largely on survey and interview data gathered from leaders in business. It is through the amplification of components of leadership that we begin to see how e-leadership departs from traditional views. Although there is still a belief in the importance of traditional leadership qualities, there is recognition that amplification of various elements is needed as technology is integrated into the context.

Phelps (2014) described a number of skills typically associated with traditional leadership frameworks that are important when harnessing the potential of technology. These include technical skills, communication skills, organization skills, team building skills, and flexibility and adaptability. In a study that focused on communication skills, participants from 54 major organizations in Romania, from state agencies to private businesses such as television stations and banks, agreed that the use of new types of communication helped to organize, control, and

streamline communication and information. However, the respondents also felt that ICT-enabled forms of communication should not replace traditional forms, but should be used in addition to face-to-face communication, because traditional forms favored direct relationships with employees (Blau and Presser 2013). Leaders and employees recognized the importance of traditional communication skills, but saw positive results when those skills were augmented by technology.

In another study on communication skills in leadership settings, researchers chose five major businesses in Finland to investigate the importance of an e-leader's ability to build trusting relationships (Savolainen 2000). One factor that played an important role in an e-leader's level of trust were the processes and techniques used for communication. When the e-leader's communication was occasional and fragmentary, the employees experienced low degrees of trust. E-leaders who were most successful deliberately pursued trust-creation, which required time and continuing efforts. These leaders recognized their important role in trust-building and identified ICT as being integral to sustained communication with their employees (Savolainen 2000).

In education. In the educational context, the idea of amplification is often seen in the ways that technology can be introduced to a school or educational ecology for one purpose, and then its affordances allow for more or different amplifications of that original purpose. It can happen that certain technology might be introduced with the assumption that it provides a basic replacement, or perhaps a minor amplification of increased efficiency, of an older or more low-tech method. But once that technology takes effect within the school ecology, unintended consequences or results (for better and/or worse) will begin to unfold based on the factors at work in the complex system.

For instance, one might see a digital school attendance system introduced, and initially assume it will replace the old system for simple daily attendance. But the affordances of the technology within the school system may produce new effects. The digitized system will provide much more data, which could allow long-term close tracking of student attendance. This could lead to effects for individual students and policy changes impacting the group overall. The ability to put attendance or even grades online (or generate instantaneous robo-calls to home on these issues), can promote a different level of information for parents, and perhaps a different level of communication, connection, and interactions between parents and school-agents. So while a basic attendance (or grading) system through digitization was the initial plan, what ensues might be a different type of participation or relationship between stakeholders, a different means of data gathering on students, or other unplanned results. This is the amplification effect, in which technology's affordances are leveraged and the power of whatever you do with it becomes amplified. What we see here is that technology is introduced to the ecology and it does not just replace—but it also amplifies (i.e., it gives us something more, than just more of the same).

13.3.4 Transformation: E-Leadership as Transformational Leadership

In business. The third view, supported by a range of researchers, suggests that there are fundamental differences between traditional leadership and ICT-mediated leadership; furthermore, the interactions between technology and leadership may necessitate changes in our assumptions about leadership itself. This last view calls for a new type of leadership to address the challenges and opportunities presented by technology. This is transformational leadership. A transformational leader recognizes the ever-changing world in which she leads and leverages the power of various technologies to inspire change.

In a large-scale study for the European Commission, researchers found that there is a growing need for e-skilled professionals, especially e-leaders. E-leaders are a new type of leader essential to organizational innovation and competitiveness: “Effective e-leaders are capable of leading teams and managing technology systems in ways that achieve both local and global demands” (European Union 2013, p. 12). Along with a definition of e-leadership the researchers voiced a concern for the lack of current and future leaders who will be prepared to lead in transformational ways. There is recognition that the changing climate of organizations requires a different form of leadership, but there is a shortage of individuals who are capable of filling those roles.

Phelps (2014) outlined a number of technologies that have been identified as contributing to the intersection of technology and leadership. These include virtual teams, communications and social media, web-based collaboration tools, management systems, and content organization tools. An area from this list that has seen a substantial amount of study is the shared leadership that occurs in virtual teams or communities.

In a paper that explored the challenges of leading and facilitating digital collaborative learning, Harris et al. (2013) found that distributed leadership is integral to good digital collaboration and is an important determinant of collaboration in a virtual environment. Gurr (2004) argued that some form of dispersed leadership would be useful in conceptualizing e-leadership.

Malhotra et al. (2007) studied virtual teams to identify effective leadership practices. These practices included the ability to: generate and sustain trust using ICT, ensure understanding of diversity, effectively monitor virtual work, manage progress using ICT, extend the visibility of virtual members, and ensure that all members benefit from the team. Kerfoot (2010) stated that new skills are required for sustaining high performing teams across diverse boundaries.

In Education. The ongoing advancements in educational technology and lack of research make e-leadership in education an essential field of study (Jameson 2013). According to Jameson, the “take up of tech innovations has not been accompanied by critical reflection, professional development, and research on the education technology leadership and management functions that ideally should accompany effective implementation of learning technologies innovation in educational”

settings (2013, pp. 890–891). Traditional views of leadership in education are changing—moving from leader-centered to models that resemble distributed leadership.

Gurr (2004) stated that e-leadership should be an important part of our view of educational leadership. Rapid developments in technology have led to new spaces for human interaction. Previous research distinctly separates the fields of leadership and educational technology. A crucial need is to bridge this gap to support successful learning and teaching with technology (Jameson 2013).

One of the few studies that has been conducted on e-leadership and education was a correlational study examining the relationships among demographic characteristics, leadership styles, technology acceptance, classroom anxiety, learning environments, and student satisfaction with course interaction/structure/support, in Taiwanese higher education. The findings of this study showed a significant correlation between teacher leadership style and student satisfaction with course interaction/structure/support. Those professors that exhibited transformative leadership styles had higher student interaction and satisfaction in their courses (Lin et al. 2010).

Franciosi (2012) argued that little attention has been given to leadership frameworks at the school, district, or government level. In a field characterized by technological innovation and change, leadership style is critical to facilitating successful use of technology that contributes to positive learning outcomes. Digital culture calls for a transformational leadership style—a move away from the traditional leader-centric form of leadership that is common in education. According to Franciosi (2012), educational leadership should be more flexible to cope with technology-driven changes and developments.

School leaders play crucial roles in the adoption of ICT. Schools are in the transition of re-culturing to accept teaching with information and communication technologies. Principals are the onsite educational leaders who shape and communicate visions of teaching and learning within their schools, and by their action or inaction influence school activity (Afshari et al. 2009; Otto and Albion 2002). In a study on the use of ICT in education in Norway researchers found that distributed forms of leadership led to an increased willingness by staff to incorporate ICT into their teaching (Ottestad 2013).

Evolution in higher education is not known for its speed. Our graduate preparation programs are holding on to core curricula in the midst of tremendous change. Online-only, nontraditional, and international students require us to adopt, adapt, and aspire to new heights. Social media provide conduits for connection, information dissemination, and conversation on a scale that far exceeds our bulletin boards and traditional communications channels (Stoller 2013).

Leaders who can master social media will be well positioned to be leading in this new area and will be able to influence the new generation. Those who cannot are going to struggle and will see their influence diminish. There are many leaders who are trying to stem this tide; there are organizations in which people are not encouraged to join in with the rise of social media, as it is viewed as something the organization cannot control. One thing that

can be pretty much guaranteed is that social media connections of tomorrow will not be the same as those of today – and leaders will need to keep up (Tredgold 2014, p. 10).

The rise of social media and mobile technologies has allowed “followers” to become loci of e-leadership, sharing information, and responding to events in a much more active way—as evidenced by the role social media users have played in responses to recent natural disasters and political uprisings. As Avolio et al. (2014) noted, these technologies open up “opportunities for followers to influence the leader and others via back-channel communication” (p. 110).

To summarize, we have argued that seeing organizations (specifically schools) as complex ecologies provides us with a far richer way of thinking about organizations, leadership, and the role of ICT. By conceptualizing ICT as one element of this complex ecology, we prevent ourselves from falling into the trap of technological determinism, i.e., simple cause and effect relationships between the induction of a new technology and its effects on organizations. Moreover, we suggest a three-fold way of thinking about how ICT’s can influence e-leadership: by replacement, amplification, and transformation.

In the next part of the paper, we look more closely at one crucial component of the ecology of schools—namely teachers and teacher development.

13.4 E-Leadership and Teacher Development

Our definition of e-leadership describes it as “a social influence process” that takes advantage of ICT to produce changes in attitudes, knowledge, behavior, and performance. For instance, research has shown that a teacher’s beliefs and attitudes are often strong indicators of their planning, instructional decisions, and classroom practices (Pajares 1992). More importantly, from the point of view of e-leadership, research has documented a relationship between the beliefs of teachers regarding implementation of reform efforts, and instructional decisions (Cornett et al. 1990; Crawley and Salyer 1995; Haney et al. 1996; Hashweh 1996; McDevitt et al. 1993).

Though beliefs and attitudes are important predictors of how teachers work, the most significant influence on how teachers’ actually practice is the *knowledge* they bring to the task. This becomes increasingly important in the world we live and work in today, which has been described as a knowledge economy—and schools, by extension, are a knowledge industry. Seeing schools as a knowledge industry implies that schools are an economic activity where success depends on obtaining, managing, and using knowledge. This is not to say that schools are not concrete objects with buildings, and infrastructure with pipes and wires and walls and playing fields, but rather that the core goal of school is “obtaining, managing, and using knowledge.” And of course, teachers are crucial mediators in making this knowledge accessible and available to learners. This does not refer to one kind of knowledge.

In fact, one of the challenges we face today (with the rise of ICTs) is that certain kinds of knowledge are privileged while others receive less attention.

More specifically, it has been suggested that we need to distinguish between four kinds of knowledge: *know-what*, *know-why*, *know-how*, and *know-who* (OECD 1996). The first two of these focus more on explicit information (facts/information in the first case and scientific knowledge, theories/principles in the second case). The *know-how* and *know-who* are more tacit in nature—focusing on skills and capabilities in the first instance, and networks and social relationships between people in the latter.

Being knowledge industries, schools (and teachers) are at the forefront of the development of all four of these forms of knowledge. It is important to note that these distinct forms of knowledge are developed differently. Teacher education programs (and schools for that matter) have typically focused on the *know-what* aspect of knowledge with some emphasis on *know-why*. In contrast, *know-how* and *know-who* have not received as much attention. This is because these relatively tacit kinds of knowledge are developed by engaging with practical experience (such as professional apprenticeships and specialized day-by-day interactions) and teacher preparation programs have typically not emphasized such forms of learning. Teachers are critical knowledge workers according to this perspective. They are the crucial mediators between knowledge in the field or domain and the learner.

If, as we have argued, schools are complex ecologies, then this lack of emphasis on *know-how* and *know-who* presents a significant gap in how we think about teacher professional development in the domain of ICT. Clearly, teacher education and development needs to focus on the development of all four kinds of knowledge, though as described above the emphasis has been more on the first two forms rather than the last two.

Moreover, teachers involved in leadership must understand that the development of IT networks has exacerbated the distinction between these forms of knowledge. Certain types of knowledge (*know-what* and *know-why*) are easier to codify, reduce to information, and transmit with limited costs. Even as we celebrate the digital revolution, the rise of the information society, and the easy availability of resources such as digitized books, journals, images, video clips, sound and voice recordings, we need to acknowledge that there are forms of teacher knowledge (connected to leadership) that are essential and important but may be missed in our focus on discrete, easily digitized bits of information. This has consequences for how we view leadership and teacher development.

Finally, teachers need to understand how organizations such as schools function. In other words, they need to develop an understanding of the fact that schools are a complex knowledge ecology—and that actions and reactions in such an environment are often nonlinear and nondeterministic. The mere introduction of ICTs into the school environment will not ensure that the processes by which the organization functions will necessarily change or improve. As we have argued, ICTs usually just function as replacements or amplifiers of existing tools and processes. To truly see the transformational nature of ICTs for e-leadership requires looking beyond the affordances of the tools to developing a better understanding of the social and

interpersonal structures that guide organizations. It is only by leveraging these broader factors (that often go beyond the technical) that true transformational e-leadership can be achieved.

13.5 Conclusion

In this paper, we have argued that though there appears to be great potential for ICTs to change the nature of leadership in educational organizations, not much has actually been done in this area. Most of the discussion has been prompted by research or thinking in the arena of business and has been dominated by a techno-centric deterministic perspective, which suggests that the mere introduction of new technologies will lead to transformational change in organizations. We have argued for a far more complicated picture, grounded in our understanding of organizations such as schools as being complex knowledge ecologies. An important consequence of seeing educational institutions as knowledge economies is that we must note the range of ways in which technologies “fit” into the eco-system (which we suggest can be seen as leading to replacement, amplification or transformation of the organization and hence the nature of leadership). Achieving genuine transformation requires that teachers and other stakeholders have to become sensitive to the complex social, cultural, and contextual aspects of organizations. This requires the development of knowledge beyond just know-what and know-why (aspects of knowledge that are often discrete and measurable), but also of know-how and know-who (both of which are far more complicated to understand). It is only then that the transformational potential of ICTs and e-leadership can be realized.

References

- Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Factors affecting teachers' use of information and communication technology. *Online Submission*, 2(1), 77–104.
- Avolio, B. J., Kahai, S., & Dodge, G. E. (2000). E-leadership: Implications for theory, research, and practice. *Leadership Quarterly*, 11, 615–668.
- Avolio, B., Sosik, J., Kahai, S., & Baker, B. (2014). E-leadership: Re-examining transformations in leadership source and transmission. *The Leadership Quarterly*, 25, 105–131. doi:[10.1016/j.leafqua.2013.11.003](https://doi.org/10.1016/j.leafqua.2013.11.003).
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective. In P. Moen & J. G.H. Elder & K. Luscher (Eds.), *Examining lives in context: Perspectives on the ecology of human development* (pp. 619–647). Washington, DC: APA Books.
- Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nurture reconceptualized: A bioecological model. *Psychological review*, 101(4), 568–586.

- Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In R. M. Lerner (Ed.), *Theory, volume 1 of handbook of child psychology* (Vol. 1). New York, NY: Wiley.
- Blau, I., & Presser, O. (2013). e-Leadership of school principals: Increasing school effectiveness by a school data management system: e-Leadership by school principals. *British Journal of Educational Technology*, *44*(6), 1000–1011. <http://doi.org/10.1111/bjet.12088>.
- Bruce, B. C., & Hogan, M. P. (1998). The disappearance of technology: Toward an ecological model of literacy. In D. Reinking & M. C. McKenna & L. D. Labbo & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 281). Mahwah, NJ: Erlbaum.
- Cascio, W. F., & Shurygailo, S. (2003). E-leadership and virtual teams. *Organizational Dynamics*, *31*, 362–376.
- Cornett, J. W., Yoetis, C., & Terwilliger, L. (1990). Teacher personal practical theories and their influence upon teacher curricular and instructional actions: A case study of a secondary science teacher. *Science Education*, *74*, 517–529.
- Crawley, F. E., & Salyer, B. A. (1995). Origins of life science teachers' beliefs underlying curriculum reform in Texas. *Science Education*, *79*, 611.
- European Union (2013). *E-Leadership: skills for competitiveness and innovation*. European Commission, Enterprise and Industry Directorate General, INSEAD Elab.
- Franciosi, S. J. (2012). Transformational leadership for education in a digital culture. *Digital Culture and Education*, *4*(2), 235–247.
- Gurr, D. (2004). ICT, leadership in education and e-leadership. *Discourse: Studies in the Cultural Politics of Education*, *25*(1), 113–124. doi:10.1080/0159630042000178518.
- Gurr, D. (2006). E-leadership. In S. Dasgupta (Ed.), *Encyclopedia of virtual communities and technologies*. Idea Group Reference: Hershey, PA.
- Haney, J., Czerniak, C., & Lumpe, A. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching*, *33*, 971–993.
- Harris, A., Jones, M., & Baba, S. (2013). Distributed leadership and digital collaborative learning: A synergistic relationship? *British Journal of Educational Technology*, *44*, 926–939. doi:10.1111/bjet.12107.
- Hashweh, M. (1996). Effects of science teachers' epistemological beliefs in teaching. *Journal of Research in Science Teaching*, *33*, 47–63.
- Hughes, J., Thomas, R. & Scharber, C. (2006). Assessing technology integration: The RAT—replacement, amplification, and transformation—framework. In C. Crawford, R. Carlsen, K. McFerrin, J. Price, R. Weber & D. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2006* (pp. 1616–1620). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).
- Jameson, J. (2013). e-Leadership in higher education: The fifth “age” of educational technology research. *British Journal of Educational Technology*, *44*, 889–915. doi:10.1111/bjet.12103.
- Kahai, S., & Avolio, B. (2004). E-leadership. In G. Goethals, G. Sorenson, & J. Burns (Eds.), *Encyclopedia of leadership*. (pp. 418–424). Thousand Oaks, CA: SAGE Publications, Inc. doi: <http://dx.doi.org/10.4135/9781412952392.n96>.
- Kerfoot, K. M. (2010). Listening to see: The key to virtual leadership. *Nursing Economics*, *28*(2), 114–115.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: U of Chicago P.
- Lemke, J. L. (1994). Discourse, dynamics, and social change. *Cultural dynamics*, *6*(1), 243–275.
- Lin, C.-P., Wang, Y.-J., Tsai, Y.-H., & Hsu, Y.-F. (2010). Perceived job effectiveness in cooperation: A survey of virtual teams within business organizations. *Computers in Human Behavior*, *26*, 339–344.
- Malhotra, A., Majchrzak, A., & Rosen, B. (2007). Leading virtual teams. *Academy of Management Perspective*, *21*, 60–70.

- McDevitt, T., Heikkinen, H., Alcorn, J., Ambrosio, A., & Gardner, A. (1993). Evaluation of the preparation of teachers in science and mathematics—assessment of preservice teachers' attitudes and beliefs. *Science Education, 77*, 593–610.
- Morgan, G. (1997). *Images of organization*. Beverly Hills: SAGE Publications.
- Nardi, B. A., & O'Day, V. L. (1999). *Information ecologies: Using technology with heart*. Cambridge, MA: MIT Press.
- OECD (Organisation for Economic Co-operation and Development) (1996). The knowledge-based economy. Paris: Organisation for Economic Co-operation and Development.
- Otto, T., & Albion, P. (2002). Understanding the role of school leaders in realizing the potential of ICTs in education. In D. A. Willis, J. Price, & N. Davis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2002* (pp. 506–510). Nashville, Tennessee, USA: Association for the Advancement of Computing in Education (AACE). Retrieved from <http://www.editlib.org/p/10565>.
- Ottestad, G. (2013). School leadership for ICT and teachers' use of digital tools. *Nordic Journal of Digital Literacy, 8*(01–02), 107–125.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307–332. doi:10.2307/1170741.
- Phelps, K. C. (2014). “So much technology, so little talent”? Skills for harnessing technology for leadership outcomes. *Journal of Leadership Studies, 8*(2), 51–56. <http://doi.org/10.1002/jls.21331>.
- Savolainen, T. (2000). Leadership strategies for gaining business excellence through total quality management: A Finnish case study. *Total Quality Management, 11*(2), 211–226. <http://doi.org/10.1080/0954412006955>.
- Stoller, E. (2013). Our shared future: Social media, leadership, vulnerability, and digital identity. *Journal of College and Character, 14*(1), 5–10. <http://doi.org/10.1515/jcc-2013-0002>.
- Toyama, K. (2015). *Geek heresy: Rescuing social change from the cult of technology*. New York: PublicAffairs.
- Tredgold, G. P. (2014). Are you connected? Leadership in the era of social media. *Development and Learning in Organizations: An International Journal, 28*(6), 9–11.
- Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*(4), 807–840. doi:10.3102/00028312040004807.

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