

Technology Leadership

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“Effective school leaders are key to large-scale, sustainable education reform” (Fullan, 2002, p. 16). There is no reason to doubt that this is true, as much for change related to technology, as for any other educational change. Nevertheless, the scholarly literature about technology leadership is relatively sparse.

In preparing this review, the seventeen presentations recorded in the 2005 SITE conference proceedings (Crawford *et al.*, 2005) were taken as a starting point and searches were conducted for publications addressing *technology leadership* in the period covering 2004 and 2005. The process entailed searching several major indices of scholarly publications (EBSCOHost, 2005; EdITLib, 2005; MCB, 2005; Taylor & Francis, 2005) and Google Scholar (<http://scholar.google.com>), using the phrase “technology leadership” with “education” and scanning the contents pages of approximately 20 relevant print and online journals for articles dealing with related themes. The number of articles found in this way was not large, as can be observed from the list of references below. It is possible that some significant articles were missed, but it seems unlikely that key themes in the current literature will have been missed.

Because the brief for this review was a survey of the current state of the field, it was not appropriate to use the identified sources to argue a case for a particular point of view. Instead, an attempt was made to categorize them according to topic. Three broad categories emerged and have been used as the basis for presenting summaries of the selected sources. Some common themes emerged through that presentation and they have been used as the basis for comments related to implications and directions.

The need for and nature of technology leadership

Reviews of research on the effectiveness of school principals have suggested that they exercise a small, but measurable and important, influence on the effectiveness of a school (Riley, 2000). However, Riley argues that “equating leadership with principalship, ... creates a narrow definition of the term” (p. 46) and proposes, instead, a notion of *distributed leadership* as a network of relationships within an organization. Crowther (2002) argues that the role of the principal in school improvement is not so much over-rated as out-dated, and proposes a model of *parallel leadership* in which teacher leadership operates alongside the leadership of the principal. Similarly, Fullan (2002) suggests a need for many leaders at many levels working together in ways that ensure leadership succession for continued organizational improvement. The apparent consensus in the educational change literature, that leadership is important and not confined to a single individual, extends into the literature about technology leadership in education.

Anderson and Dexter (2005) report on the analysis of data from the 1998 *Teaching, Learning, and Computing* survey of more than 800 schools in the USA and conclude that “although technology infrastructure is important, for educational technology to become an integral part of a school, technology leadership is even more necessary” (p. 74). The analysis looked at the relationship between technology leadership and three indicators of technology outcomes: *net use*, representing teacher and student use of e-mail and the Web; *technology integration*, representing the numbers of teachers integrating technology into various teaching activities; and, *student tool use*, representing the extent to which students used computers for academic work. Technology leadership was treated as a school characteristic, consistent with the emerging consensus concerning distributed leadership, and measured by the sum of eight dichotomous variables. These were: presence of a technology committee; principal spending five or more days per year on technology planning; principal making regular use of email for communication; presence of a staff development policy in relation to technology; budget provision for technology; district support; special grants for technology; and, an intellectual property policy. In general, larger and better-resourced schools scored higher for technology leadership but the gap was not as wide as that in school technology spending. Technology leadership had a significant positive correlation with each of the three outcome variables, and was the strongest predictor for all three. The ratio of students to computers was the only other variable to significantly predict all three outcome measures. Because “technology leadership has greater leverage on desired outcomes than does technology infrastructure and expenditures” (Anderson &

Dexter, 2005, p. 73), further research into the nature of technology leadership, including its distributed nature, is needed to address the challenges inherent in the educational applications of technology.

Other recent studies confirm the importance of leadership as an influence on teachers' use of technology. Piper and Hardesty (2005) obtained data from 160 teachers in Pennsylvania. Their instruments included measures of teacher attitudes toward learning about and working with computers, and their perceptions of school leadership. Their analysis suggested that different leadership styles or behaviors were effective for encouraging positive attitudes in different circumstances. Leadership evincing inspirational motivation was effective for encouraging teachers to learn how to use computers, but other traits, such as understanding needs, providing assistance and demonstrating what is required, were more effective toward encouraging teachers to use computers in the classroom. The implication is that leadership needs to be flexible.

Analysis of data obtained from 1490 Massachusetts elementary teachers in 96 schools as part of a larger study "suggests that school and district policies, practices and leadership can influence the ways in which, and extent to which teachers use technology for a variety of purposes" (O'Dwyer *et al.*, 2004, p. 16). That study measured four different uses of technology as outcomes: delivering instruction; directed student use in class time; student creation of products; and, teacher preparation. Only one variable, teacher beliefs about positive impact of computers on students, was a significant predictor of all four outcome measures, leading to recommendations regarding how schools or districts might focus on specific factors in order to increase different outcomes. Once again, the value of flexibility in leadership is emphasized.

Case studies of three urban elementary schools in which technology leadership, in the form of support from the principal for equipment and staff was present, revealed very different results upon closer analysis (Staples *et al.*, 2005). The analysis suggests that three scaffolds, each associated with leadership, support technology integration. These were *alignment* of technology use with the curriculum and mission of the school, the presence of *teacher leadership* allowing teachers agency to influence technology development throughout the school, and *public/private roles* for technology that recognize and empower teachers and students working with technology. These cases illustrate the variety of elements that make up successful technology leadership and the advantages of a distributed model of leadership.

Probably the most easily recognizable example of distributed leadership in relation to technology is the position variously described as technology coordinator, computer coordinator or ICT (Information and Communication Technology) coordinator. That role has been explicitly cast as an example of shared or distributed leadership in which task-relevant expertise is critically important (Lai & Pratt, 2004). As part of a larger three year study of ICT use in secondary schools in the province of Otago in New Zealand, Lai and Pratt collected data from ICT coordinators in 21 schools of the Otago province in New Zealand, using surveys and interviews. Additional survey data collected from principals and teachers were also included in an analysis of the work of coordinators. The analysis paints a detailed picture of the coordinators and their work in schools. The knowledge and enthusiasm of the coordinators equipped them to provide leadership for ICT implementation but, although colleagues respected them as leaders, their roles were not formally recognized at school or wider levels, and little or no time was allowed for what was seen as an addition to existing responsibilities. For their work to be effective, coordinators need to be recognized as leaders and provided with the resources necessary to adequately perform the role.

This lack of formal recognition of a leadership role for coordinators is consistent with continuing acceptance of traditional approaches to leadership elsewhere. Data obtained from 268 principals in Florida revealed that only 59% considered that their technology knowledge and skills equipped them to be technology leaders but, at the same time, almost 50% were unwilling to give decision making about technology over to teachers (Brockmeier *et al.*, 2005). The implication is that many principals find themselves exercising leadership in an area for which they feel less than qualified, but may be unwilling to share leadership because of traditional expectations about their roles.

A study undertaken in a Hong Kong primary school used classroom observations, interviews with school personnel and document analysis to develop a substantial case study with a focus on conditions that promoted and inhibited Innovative Pedagogical Practices Using Technology (Tong & Trinidad, 2005). Aspects of leadership were found to be important factors for both promoting and inhibiting the use of technology. The study identified visionary leadership, the development of appropriate policies and plans for technology implementation, understanding of teachers' individual progression with technology, and participatory decision making as important aspects of leadership for promoting technology use.

Visionary and cultural dimensions of technology leadership

The visionary and cultural dimensions of leadership are recurring themes in both the wider literature of educational leadership (Crowther, 2002; Fullan, 2002) and that of technology leadership in education. Anderson and Dexter (2005) point to the importance of vision as an element of leadership and to the need to address culture as part of technology leadership. Similar threads are present in the findings of other studies (Staples et al., 2005; Tong & Trinidad, 2005) described in the previous section.

Coppola (2005) reports on an ethnographic study of five teachers from different subject areas in a large comprehensive public high school. Observations of, and interviews with, the teachers were supplemented by interviews with other personnel at the school and district level. The school de-emphasized workshops for professional development in technology and, instead, supported teachers as they worked individually to connect their learning about technology with their teaching. She found that the teachers had been learning about technology over an extended period of at least ten years, and had developed new practices rather than adopting approaches from others. The organizational culture emphasized continuous learning for both adults and children as central to its mission. These cultural norms were supported and promoted by school and district leadership with the result being teachers empowered to find their own ways forward with technology.

Adamy and Heinecke (2005) used a symbolic interactionist perspective to examine the experiences of four mathematics teacher educators working in four different schools of education in Virginia. Data were collected using interviews, classroom observations and document analysis. Each of the participants was a willing user of technology, and all four organizations were supportive of technology integration. Nevertheless, the experiences of the participants differed, with three reporting positive experiences and the fourth experiencing some setbacks associated with a mistaken organizational assumption that, "as a member of a faculty that has historically not used technology, (he was) unable or unwilling to integrate technology into his practice" (p. 251). Despite prior successful experience of technology integration at another university, the fourth participant experienced difficulties because his vision for technology was at variance with that of the organization. The power of organizational culture to shape experience positively or negatively is evident.

Theories of social capital and networked organizations have been proposed as new models for informing and understanding technology leadership in education (Kowch, 2004). This paper adopts a structural view of social capital as networks of interacting individuals or organizations in which the networks may be characterized as bonding (within homogeneous groups), bridging (across horizontal social cleavages) and linking (between different strata). It describes, with examples, how low and high capacity (social capital generating) networks operate, and how high capacity networks can enhance leadership. There is an apparent link between the concept of social capital created in networks and the growing interest in distributed leadership. Leaders prepared to use technology to extend their networks should have opportunities to generate greater social capital with resultant increased capacity to influence outcomes.

The final paper to be mentioned in this section is, perhaps, the most challenging in its conclusions. Somekh (2004) contrasts the impact of ICTs on young people's lives outside school with the lack of impact of ICTs on education systems and concludes that the difference can only be accounted for in terms of the institutional function of schools and education systems as a whole. She suggests that schools are locked into systems of mutual constraint in which the capacity of the authorities to implement change is frustrated by the capacity of informal networks of teachers to adapt changes to their traditional practices; while, at the same time, teachers are constrained by the formal organization from using their informal networks to engage in creativity. Further, characteristics of the Internet and ICTs, such as their individualistic and anarchic qualities, are inherently antipathetic to the culture of school. She describes four examples of institutionalized resistance to ICT and points to three bodies of theory, drawn from McLuhan (1964), Turkle (1984, 1995) and Vygotsky (Wertsch, as cited in Somekh, 2004), "that show that to be transforming, ICTs need to become an integral part of human activity" (Somekh, 2004, p. 177). She ends with a call for radical reform of schooling:

The mutual constraints that render school leadership powerless to direct effective change from above and the informal networks of teachers powerless to produce creative change from below are clearly indicated in the evidence of (non) impact of ICTs on education systems over a period of more than 20 years of high levels of investment by policy makers. It is time for the end of school as we know it.
(Somekh, 2004, p. 177)

In effect, Somekh argues that the existing culture of schools is so deeply entrenched and so inimical to the incorporation of ICTs that visionary technology leadership, whether by principal or in a distributed mode, is unlikely to be able to effect the cultural changes necessary for ICT to have an impact. Researchers in the broader

arena of school improvement have reported successful school revitalization that has included organizational culture-building as a key process (Crowther, 2002). Whether those approaches are equal to the challenge Somekh sees posed by ICTs is not clear but may warrant careful investigation.

Technology and the work of educational leadership

The previous sections have focused on how leadership can influence the implementation of technology in education. However, it is equally relevant to consider how technology might influence the work of leadership, in its day to day practice and in the expectations of leaders and their preparation through and for working with technology.

By this time, most educational leaders can be assumed to be making use of readily accessible technology such as common productivity applications like word processors. Indeed, the use of email by the principal has been included as an indicator of technology leadership in a school (Anderson & Dexter, 2005), and some studies have described more specialized applications such as the use of streaming video to facilitate evaluation of teacher performance in classrooms (Peyton *et al.*, 2005). Nevertheless, there is a continuing need for preparation and professional development of technology leaders on both dimensions, leadership and technology.

As noted above, principals have reported both lacking expertise as technology leaders and being reluctant to pass decision making about technology to others (Brockmeier *et al.*, 2005). In the same study, principals reported a desire for more professional development related to technology leadership. The vast majority reported having received professional development in using application software but was interested to receive development more directly related to technology integration in the curriculum. A study conducted in Alberta, Canada, surveyed school and district leaders “to ascertain existing (technology) leadership capacity, understand current (technology) leader needs, and provide direction in building future (technology) leadership capacity” (Mrazek *et al.*, 2005, p. 1820). The data indicated a lack of agreed upon standards for technology leadership, especially at the district level, and variable perceived levels of preparation in relation to knowledge of ICT integration. Participants indicated that effective technology leadership requires substantial knowledge of both education and technology. Experiences reported from jurisdictions where appointments had been made on the basis of strength in education or technology, but not the combination, confirmed that the results in either case had been less than desired. The paper concludes with recommendations concerning the design of postgraduate courses to prepare technology leaders.

Although specific preparation for technology leadership is most commonly offered within postgraduate programs, Lundeberg *et al.* (2004) report on a program in which a Technology Leadership Cadre (TLC) of preservice teachers were employed “as leaders in technology to change teacher education curriculum, and to mentor and support inservice teachers, teacher education faculty and preservice teachers” (p. 33). The work of TLC benefited the whole teacher education program by encouraging and supporting increased integration of technology as faculty and students gained increased skills and expectations of what was possible. TLC members gained leadership experience and demonstrated leadership among their peers. Whether that experience will equip them to be technology leaders in their future schools remains to be seen. If the future of technology leadership lies in a distributed model that provides opportunities for teacher leaders, then the development of leadership capacity in preservice programs may be an important element in any plan to ensure that suitably prepared technology leaders are widely available in schools.

Research suggests that “although the prolific use of ICT in school administration is at an early stage in many countries, in some it is changing the school working environment” (Gurr & Broadbent, 2004, p. 20). For principals, the encroachment of ICT into the school has impacted on knowledge and skills, ways of working and educational leadership. For mid-level leaders the same impacts are evident, although to a lesser degree. ICT has changed the work environment sufficiently to suggest a new conceptualization of leadership: e-leadership (Gurr & Broadbent, 2004). Gurr (2004) describes three current views of e-leadership that are not directly connected with education but may provide insights into how the concept will develop. The first treats e-leadership as continuous with existing views of leadership but with a new label most obviously related to organizational image. The second acknowledges that what is known about good leadership continues to apply but that there are additional paradoxes and dilemmas associated with the application of ICT that may lead to a more dispersed view of “hyperlinked”, rather than “hierarchical”, leadership. The third uses evidence from research to suggest that ICT-mediated environments affect leadership behavior and that assumptions about leadership may be changing as a result. The implications for educational leadership may include parallel changes in leadership behavior and uses for ICT, need for leaders to exhibit interpersonal skills in different ICT environments, and dispersed leadership.

Gibson (2005) describes two projects in which graduate students in educational leadership programs have used technologies, including asynchronous forums and video conferencing, to engage in global forums with peers. The paper “recognizes the potential power of learning and communicating technologies for transforming the way learning is conceived and constructed” (p. 1791) and argues for potential benefits, not only to learning but to international understanding. Gibson suggests that “each of these projects incorporates the process of integrating networking and connectivity technologies as natural extensions of the constructivist philosophies at the heart of these programs” (2005, p. 1793) but it may be that emerging theories of learning, such as connectivism (Siemens, 2005), provide an even more appropriate basis for understanding these innovations. Theories of social capital (Kowch, 2004) and understandings of e-leadership (Gurr, 2004) may also be relevant.

Implications and directions

The most obvious conclusion to be drawn is that there is a relative paucity of recently published scholarship in the field of technology leadership. Despite considerable scholarly activity in the broad fields of educational leadership and of technology in education, there appears to be relatively little activity in the conjunction of the two. There seems little doubt that technology leadership is widely viewed as important (Anderson & Dexter, 2005; Gurr & Broadbent, 2004; Mrazek et al., 2005; Tong & Trinidad, 2005). A partial explanation may be related to the observation that effective technology leadership requires substantial knowledge of both education and technology (Mrazek et al., 2005). Perhaps researchers with strong backgrounds in education or technology are reluctant to venture into the intersection of those fields, where they would be less confident of their ground. There would be value in organizations such as SITE providing more opportunities for engagement between researchers in these fields.

There is a powerful case to be made for leadership to be conceptualized, other than as the prerogative of a single individual in a school or as vested in an hierarchically arranged set of individuals at different levels in a wider organization. Descriptions of leadership as distributed (Riley, 2000), parallel (Crowther, 2002) or dispersed (Gurr, 2004) are increasingly common, and reflect newer understandings of the complexity of human activity (Downes, 2005) and the nature of knowledge as connected (Siemens, 2005) or distributed (Downes, 2005). It may be that effective technology leadership will come to be seen, not so much as dependent upon the capacity of an individual to span the domains of education and technology (Mrazek et al., 2005), as on the creation of social capital by bridging and linking networks within which the relevant knowledge is distributed (Kowch, 2004). Research is needed into how the social and technological networks required to support these new forms of leadership could be created and sustained. As an organization with membership working in diverse fields of knowledge and geographical locations, and with significant technological capacity, SITE should be in a position to model the creation and operation of such networks. SITE members with an interest in technology leadership should be active in the conduct and application of research on leadership networks in educational institutions and within their own organization.

The role of organizational vision and culture is a recurring theme in the sources reviewed. Vision and culture have been shown to exert an influence on the implementation of technology in education (Adamy & Heinecke, 2005; Coppola, 2005; Piper & Hardesty, 2005; Somekh, 2004; Staples et al., 2005; Tong & Trinidad, 2005). Somekh (2004) suggests that deep incompatibilities between ICT and the culture of schools may be incapable of resolution other than by a radical redesign of our educational institutions. However, other researchers argue that real improvement in schools is possible through processes including organizational culture-building (Crowther, 2002). There is need for further research into the cultural roles of technology leaders and into the cultural forms that may be appropriately suited to the implementation of technology in education. SITE could contribute through research by its members and through developing its own vision and culture in ways that demonstrate how technology leadership can be effective in building and maintaining an appropriate culture.

Although the NETS-A (ISTE, 2000) represents a useful start, more needs to be known about the characteristics required of technology leaders and how those can best be developed. Technology leaders require knowledge of both education and technology (Mrazek et al., 2005) and, in distributed leadership models, will be needed at multiple levels in educational organizations (Anderson & Dexter, 2005; Lai & Pratt, 2004). Programs that prepare preservice teachers to exercise appropriate leadership in areas where they have developing expertise (Lundeberg et al., 2004) and those that prepare leaders to work in networked environments (Gibson, 2005) may be of particular value and deserve further study.

It is worth noting that The Stellenbosch Declaration (IFIP Committee on Education, 2005), produced by a globally representative group of educators expert in ICT, echoes these conclusions in its calls for decisions

about ICT in education to be informed by both technical information and a vision for education, for innovative teachers empowered to lead change and for inclusive global networks to facilitate access to knowledge. SITE can play a significant role towards ensuring the development of technology leadership in ways that make the benefits of ICT in education more accessible to all.

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