

# New Technologies and The Challenge for School Leadership

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In considering the role that leadership plays in the successful use of technology for urban school reform, one must first consider the overall role of school leaders. Are school leaders responsible for setting vision, managing day-to-day business, setting instructional standards, meeting payroll, or communicating with parents and other “clients”? The answer, of course, is all of the above and more. This diversity of potential roles is what makes the job of school leadership so complex. Here we briefly consider the challenges that school leadership faces in bringing the current state of the art in technology into pervasive use in schools.

Writing about organizations in general, a business theorist makes a distinction between *leadership* and *management*, claiming that the latter is about coping with complexity, while the former, by contrast, is about coping with change (Kotter, 1998). The distinction is further clarified through examples of high-level tasks: setting a direction (leaders) vs. planning and budgeting (managers); aligning people (leaders) vs. organizing and staffing (managers); and motivating people (leaders) vs. controlling and problem solving (managers). “Without good management, complex enterprises tend to become chaotic in ways that threaten their very existence” (Kotter, 1998, p. 40). It is clear that schools and school districts, which are *very* complex enterprises, require good management. But the public rhetoric associated with schooling for the past fifteen years has been focused on *reform*. Reform, which at its heart is about change, requires leadership.

Educational technology has been a part of schooling since schooling began. The lecture, as devised by Aristotle, is in fact a technology designed to facilitate the teaching and learning process. Less ancient technologies, such as the blackboard and the book, have become standards in the repertoire of schools. But newer technologies, such as radio, television, and now computers, have not been as successful as their predecessors in becoming a standard part of teaching in schools. Cuban (1986) argues that these failures occurred because the technology did not fit well with the accepted routines of teaching; they did not fit the culture of the classroom. This idea was later refined to describe failures of reform in general in terms of a lack of fit between the innovation and the “grammar of schooling” (Tyack & Cuban, 1995). When this “grammar” (culturally acceptable norms for teaching, learning, and managing) is violated, the result is the rejection of the innovation.

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The newest technologies, especially the Internet, break with the grammar of schooling in major ways, and for that reason it is the introduction of these technologies which provide the greatest challenge to school leaders. Often schools are encouraged to think of “doing” technology as a thing unto itself. In a setting where the focus is, correctly, on reading, writing, mathematics and science, technology presented as a thing apart will most likely become marginalized.

While the challenge is daunting, we think leadership practice that seeks the purposeful integration of technology into the culture of schools can combat marginalization. Vehicles like project-based learning (e.g., Blumenfeld et al., 1991) and other forms of pedagogy rooted in constructivism (e.g., Duffy & Jonassen, 1992) may give leaders a way to infuse technology in buildings that more easily fits the grammar of schooling. While these reforms also contain elements that challenge the existing grammar of schooling, they have an advantage in that they focus leaders on the essential intellectual work of schools. If technology is thought of as embedded in the core tasks of schooling, its’ successful integration into everyday practice may be a more manageable negotiation between the culture, capacity, and management and policy norms that exist within the school or school system. The demands put upon those elements of the school system by the innovation may be made more rational when technology is thought of as part of the intellectual fiber rather than something new and essentially apart. (Blumenfeld, Fishman, Krajcik, Marx, & Soloway, in press). Overseeing this process and establishing the necessary level of integration is perhaps the greatest challenge facing school leaders today.

### **Leadership as a Practice and as a Process**

New theories of learning and cognition, such as social constructivism, have not only helped us think about teaching. They are also shaping the ways in which we consider the role of the individual in an organization, and the way that the actions of a leader can be shaped as much by the tools and resources available, and by the actions of others, as by the knowledge and intention of that leader.

For example, many instructional reform efforts have focused on improving the skills and knowledge of individual teachers, because prior conceptions of instruction have been focused on the teacher, alone, as the single important variable. But instruction is really an interactive system comprised of teacher, students, and materials (curriculum and technology), argue Cohen and Ball (1999). They go on to argue that if “instructional capacity is a property of interactions among teacher, students, and materials, then interventions are likely to be more effective if they target more interactions among more elements of instructional units, rather than focusing on one element in isolation from others” (Cohen & Ball, 1999, p.7).

Spillane and his colleagues extend this view of instructional reform to create what they call a *distributed framework* for investigating school leadership as a practice, looking at the “dynamic interaction between multiple leaders (and followers) and their situational and social contexts” (Spillane, Halverson, & Diamond, 1999, p. 5). Their working definition of leadership is premised on the following three assumptions:

- Leadership is best understood through the *tasks* of formal and informal leaders;
- Leadership is *stretched over* the practice of actors within an organization;

- Leadership is *distributed* through the materials and symbolic artifacts in an organization.

They thus define instructional leadership as “the identification, acquisition, allocation, coordination, and use of the social, material, and cultural resources necessary to establish the conditions for the possibility of teaching and learning in schools.” (Spillane et al., 1999, p. 15). Spillane et al., go on to summarize the extant literature on leadership into the following “essential functions of transformative leadership”:

- Constructing and selling an instructional vision;
- Developing and managing school culture conducive to conversations about the core technology of instruction by building norms of trust, collaboration, and academic press among staff;
- Procuring and distributing resources, including materials, time, support, and compensation;
- Supporting teacher growth and development, both individually and as a faculty;
- Providing both summative and formative monitoring of instruction and innovation;
- Establishing a school climate in which disciplinary issues do not preclude instructional issues.

### **The Internet: The Most Challenging Educational Technology Yet?**

The Internet, we argue, represents a new class of technologies for classroom use that is more difficult to integrate into schools than previous technologies. Unlike previous computer technology, such as early integrated learning systems (ILSs) (Newman, 1992) or drill and practice software which are self-contained and controlled entirely from within the school or within the classroom, the Internet is a classroom technology that requires coordination between the classroom and the outside world in order to work<sup>2</sup>. There is potential for difficulty at all levels: the teacher and students using the Internet as a learning tool; school-level administration arranging for teachers and students to have access to the Internet during instructional periods; the maintenance and support of the Internet both at the school level and at the district level; and the provisioning of the Internet at the district level. Some of these areas have been well-researched, particularly issues relating to how teachers and students use and learn with the Internet in the classroom (e.g., Fishman, 1999; Fishman, 2000; Klingenstein, 1993; Levin, Kim, & Riel, 1989; Riel, 1992), but most, particularly the areas related to management and support of the Internet as a learning tool, have not, and there are therefore few guidelines for school leaders venturing into this new domain. As with any new practice or tool intended for the classroom, leaders need to create opportunities for teachers to become comfortable with aspects of teaching and classroom management that relate to the use of the Internet (Marx, Blumenfeld, Krajcik, & Soloway, 1997). We will not pursue within-classroom issues at length here, as they are at play in all situations, whether or not one is attempting to introduce a technology such as the Internet in a systemic manner. The present lack of adequate professional development for teachers on the use of technology has been well documented (CEO Forum on Education and Technology, 1999).

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<sup>2</sup> One might argue that instructional television (ITV), a technology popular in the 1960s, is also an example of a technology that required such coordination. In large part, ITV failed to be widely adopted *because* of these coordination issues, in that teachers were not comfortable setting their teaching schedules by the broadcast schedules (Cuban, 1986). ITV was supplanted by the use of VCRs in the classrooms, effectively restoring control to the teachers and making television a technology that could be controlled entirely from within the classroom by the teacher.

At the level of the individual classroom teacher, the Internet is challenging above and beyond issues of whether or not students are learning because the Internet connection to the classroom is dependent upon the cooperation and coordination of multiple levels of the school system. A teacher can plan a lesson using stand-alone software and, assuming that the computers are working and available (which depends on having building staff who are knowledgeable about computer maintenance, another difficult issue), be reasonably confident that all will go as planned. The Internet, on the other hand, may not be available when it is needed, and there is no way for the classroom teacher to predict ahead of time (even minutes ahead of time) whether or not this will be the case. Our experiences to date indicate that in K-12 settings, the Internet is “down” more than it is “up,” making such planning a bit of a gamble for teachers. But the problem is even more complex than it seems. When the Internet is “down” in the classroom, the problem could be in: (a) the configuration of the individual computer or its software, (b) the wiring or hubs in the room, (c) the wiring, hubs, or routers in the school building, (d) the wiring between the school building and the network office (usually located in the central school administration building), (e) the wiring, routers, software, or hardware in the network office, or (f) the connection to the Internet provider “upstream” from the school district. Alternatively (g), there could be no physical problem *anywhere* in this complex system, but the individual Internet web site or sites the teacher or student was trying to reach may be momentarily unavailable. If a teacher is to feel confident enough to use the Internet in everyday teaching, there needs to be a tremendous amount of coordination among different levels of the school system in order to provide a reasonable level of reliability and re-assurance. After all, given all of the different places at which Internet connectivity *could* fail, who can or should a teacher call when there is a problem?

We conjecture that traditional school management practice has not kept up with technology it seeks to manage. Consider for example the “help desk” that many districts institute to handle computer problems. The help desk as a solution has its roots in industry, which has a different cost support structure than is typically found in school districts. These phone-in systems are not convenient for teachers who do not have phones in their classrooms, and they are not designed to handle “emergencies,” such as a teacher who has a lesson that requires Internet access but finds that the network isn’t working. The help desk typically is designed to record problems, assign a “job ticket,” and dispatch the appropriate resources to fix the problem when they are available. Many teachers and building administrators have told the authors that rather than wait for repairs using this cumbersome method, they have, on their own, turned to outside contractors to repair problems. Unfortunately, these outside contractors frequently make repairs that are not compatible with the standards for computers in the school district, or they take advantage of the schools in other ways, such as using sub-standard parts. Everyone seems to recognize that this is an important problem to solve, but the cost of solving the problem (in terms of personnel) is so high that no solution is forthcoming. This disconnect is, at least in part, rooted in technology management and leadership practices that are optimized for older, less interconnected and immediate technology.

### **The Dichotomy Between Business and Academic Computing**

The help desk as a problem solving mechanism is rooted in centralized administrative services for such tasks as payroll, human resource management, and similar “business” functions of the

school district (as opposed to “educational” or “curricular” functions). These organizations go by various names, but can be referred to generically as “management and information services” (MIS) departments. As most school districts used computers and networks for the management of their business functions long before the classroom use of computers became popular (Hodas, 1993), these MIS departments were logical candidates for overseeing the purchasing and use of classroom computers as well, since they already had experience with the required technologies<sup>3</sup>. These organizations had not previously had to cope with the highly interactive and interconnected curriculum and education applications made possible by the Internet in the classroom. This new role for MIS is giving rise to new problems and a new need for organizational coordination.

### **Coordination and Support**

Another indicator that school leadership practice has not kept pace with current technological realities is the coordination between the school district and outside contractors who provide Internet services. For example, in the past when school leaders interacted with the phone company its coordination only extended to the central office and minimal phone service to individual schools. The advent of the Internet has changed this.

For example, in one district where we have worked, the school district needed to coordinate with the local phone company in order to have high-speed Internet lines installed connecting the schools to the central office. At the point where the phone company started to install the necessary lines, however, a coordination problem arose – there was nobody at the school sites qualified to oversee the installations. At one school, a ditch for new cabling was dug and then filled in again before the actual cable was laid. At other schools, the phone company installed the Internet services (and began charging the district for it), but didn’t tell anyone that the work was completed so that the district personnel could complete the hook-up inside the building. In other schools, the building administrators were not clear about which classrooms should receive Internet services, with the result that initially the network was not established for the teachers who needed it most. All of these issues were related to coordination problems among the different levels and departments of the school district.

Our point here is not to vilify the phone company or school leadership. Rather we want to point out that the day-to-day practice of leading and managing in schools has become out of sync with the technology that makes it possible. In a world where the practice of leading school districts is in sync with technology, both the phone company and school leaders would have foreseen the pending disconnect. We would expect that individuals in either the school system or the phone company could have prevented many of these problems, had they been empowered to do so. However without organizational structures in place to “mine” the required expertise that is distributed across people, there is no reason for the system to be able to try to access to it.

The forgoing discussion is not meant to imply that there was *no* success. In several school buildings, computers did function well and teachers were able to use them for instruction. Where this was the case, it was attributable to the presence of someone inside the building (e.g.,

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<sup>3</sup> It should be noted, however, that much MIS expertise was rooted in the support of the large mainframe computers typically used to handle tasks like payroll, and the arrival of desktop PCs was, in itself, a challenge to the structure of these departments.

a computer teacher or support person), who had a good understanding of computers and who understood the intent of the reforms that the technology was intended to support. The presence of a skilled computer support person<sup>4</sup> is usually a reflection of the building-level administrator's understanding of the difficulty in maintaining computers, and the importance of "local" expertise. However, even in schools that had such a person, the Internet remained problematic because it requires coordination *beyond* the school building. Our claim is that these people and others would have been much more successful and valuable to the system had management and leadership practice evolved to the point where the organization was better situated to use their insights.

### **Policy Related to Security and Safety**

We offer one final example of the evolutionary challenges in management and leadership as they relate to technology. In our last example we focus on security. Key internal records such as grades and human resources information must be protected from outside attack, and children and others must be protected both from objectionable materials and objectionable people. The Internet, clearly, did not create these problems. It does, however, challenge leaders to think differently. Most districts have "acceptable use policies" for students, teachers, and other personnel who use the Internet (Fishman & Pea, 1994), but these are just a first step. A common solution to these problems is to operate a "firewall" computer that monitors all requests for information from the Internet and allows access to approved sites and denies access to sites that are not approved. Firewalls seem to make sense, given the historical tendency of MIS departments to worry more about the protection of information than the access to it. The problem arises in that the firewall can create a bottleneck that makes the network unusable at times of peak demand. Firewalls by default also block access to new forms of network tools, such as those enabled by Java applets. Problems such as this one pose particular threats to the innovative use of technology in schools, as the security system design can inadvertently make it very difficult to implement more advanced forms of technology for learning as they become available. Firewalls, like help desks, are a tool of management that does not take advantage of the affordances of the technology. Rather than making the technology more useful these forms of technology likely stymie its effectiveness. We do not have the "correct" answer to this dilemma. The answers rest in the experience of schools leaders. We do believe that school leadership practice in these, and other domains, will evolve. The evolution will compel leaders to adjust time honored practices to the new Internet age. We further conjecture that with the proper scaffolding this evolution will be spurred to meet the needs of schooling with technology with a much more coordinated response. We turn to this point in our summary.

### **Summary: Roles and Challenges for School Leadership**

In summary, the core challenge for educational leaders is to guide the implicit and explicit negotiation process that must occur to match the demands of innovations, including new technologies, to the existing culture of the school system. Along these lines, from our

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<sup>4</sup> The issue of personnel is an important one, but we will not go into it in depth here for reasons of space. Ideally, we believe that schools would have a "technical support person" as an FTE. No principal would open their building without an engineer on the premises. We think that the same should be true for someone who, ultimately, will be critical in the support of the learning infrastructure in the building. Currently, such roles are assigned to classroom teachers who have enthusiasm, but limited expertise and/or time.

experiences to date, we have identified the following key issues to which central office and building level administrators should attend:

- Acquire the technology. We start here because nothing substitutes for hands-on experience with technology. Every district, and school community, will experience the introduction of technology differently. Therefore, for all other advice to make sense it must be constituted in the context of local experience;
- Coordinate and align curriculum, pedagogy, and assessment. Recognize and articulate the curricular reasons that the technology is being implemented. We conjecture that the leadership and management, with respect to technology, will be made easier if it is guided by a curricular vision. Curricular mandates and vision will serve as a partial guide for the myriad of judgements with which leaders must contend. Part of this guidance will come from external calls for accountability in light of school goals and newly emerged standards;
- As Spillane, et al. (1999) suggest, recognize and design organizational structures that take advantage of the distributed nature of expertise. Leaders should (1) convene and coordinate corporate and other institutional partners, (2) mobilize teachers, parents, and school partners in pursuit of school goals, (3) cultivate norms of professionalism among all staff members with respect to each individual's role in the health of the technical infrastructure, and (4) provide professional development opportunities for teachers;
- Make the rationale for technology support public by (1) setting technology policy and standards, (2) coordinating and implementing strategic planning, and (3) maintaining public technology resource inventories (e.g., lists of contractors, in-house experts, etc.).

The essential point in this essay is that school leadership, as it concerns technology, is currently under profound re-negotiation. Most schools leaders today are in the early part of the learning curve. We need to get smarter about how to encourage and support new learning. The Joyce-funded Administrators' Reform Community project is one such attempt. We also need to encourage school leaders to be more reflective about how to use all the things they currently know, in productive ways, to meet these new challenges. We, like others (e.g., Brown & Duguid, 2000), think that part of the solution lies in community. If communities of schools leaders can be formed and can shape themselves into new communities of practice that share and develop expertise, new sense making with technology will come about more rapidly. Today's school leaders have not failed in technology implementation. Rather, like the earlier experiences of their private sector colleagues, they must evolve new practice to seize new opportunities.

## References

- Blumenfeld, P., Fishman, B. J., Krajcik, J., Marx, R. W., & Soloway, E. (in press). Creating usable innovations in systemic reform: Scaling-up technology-embedded project-based science in urban schools. *Educational Psychologist*.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26(3&4), 369-398.
- Brown, J. S., & Duguid, P. (2000). *The social life of information*. Boston: Harvard Business School Press.
- CEO Forum on Education and Technology. (1999). *Professional development: A link to better learning* (Year Two Report). Washington, DC: CEO Forum on Education and Technology.
- Cohen, D. K., & Ball, D. L. (1999). *Instruction, capacity, and improvement* (CPRE Research Report Series RR-043). Philadelphia: University of Pennsylvania Consortium for Policy Research in Education.
- Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York: Teachers College Press.
- Duffy, T. M., & Jonassen, D. H. (Eds.). (1992). *Constructivism and the technology of instruction: A conversation*. Hillsdale, NJ: Erlbaum.
- Fishman, B. (1999). Characteristics of students related to computer-mediated communications activity. *Journal of Research on Computing in Education*, 32(1), 73-97.
- Fishman, B. (2000). How activity fosters CMC tool use in classrooms: Re-inventing tools in local contexts. *Journal of Interactive Learning Research*, 11(1), 3-27.
- Fishman, B., & Pea, R. (1994, Spring). The internetworked school: A policy for the future. *Technos*, 3, 22-26.
- Hodas, S. (1993). Technology refusal and the organizational culture of schools. *Education Policy Analysis Archives*, 1(10).
- Klingenstein, K. (1993). *The Boulder Valley Internet Project: Early lessons in early education*. In INET '93:
- Kotter, J. P. (1998). What leaders really do, *Harvard Business Review on leadership* (pp. 37-60). Cambridge, MA: Harvard Business School Press.
- Levin, J. A., Kim, H., & Riel, M. M. (1989). Analyzing instructional interactions on electronic message networks. In L. M. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 185-213). New York: Praeger.
- Marx, R., Blumenfeld, P., Krajcik, J., & Soloway, E. (1997). Enacting project-based science. *Elementary School Journal*, 97(4), 341-358.
- Newman, D. (1992). Technology as support for school structure and school restructuring. *Phi Delta Kappan*, 74(4), 308-315.
- Riel, M. (1992). A functional analysis of educational telecomputing: A case study of Learning Circles. *Interactive Learning Environments*, 2(1), 15-29.
- Spillane, J. P., Halverson, R., & Diamond, J. B. (1999, April). Towards a theory of school leadership practice: Implications of a distributed perspective. Paper presented at the Annual Meeting of the American Educational Research Association. Montreal, Canada.
- Tyack, D., & Cuban, L. (1995). *Tinkering toward utopia: A century of public school reform*. Cambridge, MA: Harvard University Press.