Administrative problem solving in the information age

Creating technological capacity

Lynne G. Perez and Cynthia L. Uline
The Ohio State University, Columbus, Ohio, USA

Keywords *Administration, Problem solving, Computers, Computer management*

Abstract *The information age is upon us. In schools across the country, administrators are making important decisions about how best to employ computer technology. This case study of an expert educational administrator looks at computer use from a problem-solving perspective, focusing on the relationship between how this school leader thinks about and acts on technological capacity. It examines the personal attributes and perceptions that underlie his effective application of technology and finds them interwoven with the same cognitive and behavior skills he employs across his problem solving. It explores the connections he makes between school and community and between administrative and instructional technology.*

Introduction

Problem solving lies at the heart of educational administration. Daily, problematic situations, emerging from the complex and unpredictable nature of the school environment (e.g. Greenfield, 1995), compel school leaders to create solutions. As problem solvers, educational administrators must gather, make sense of, and communicate information. Computer technology offers educational problem solvers quick access to data and the tools with which to retrieve, manage, and report it. Telecommunication networks link inquiring administrators to rich sources of problem-applicable information, and word processing and electronic mail enhance the quality and timeliness of written communication. Yet, while scholars suggest that school administrators recognize the computer's potential to support their practices, they also acknowledge that few administrators possess the competence or capacity to effectively utilize digital technology (General Accounting Office, 1995; Kearsley, 1988). Endeavoring to understand the discrepancy, researchers have identified the necessary competencies (e.g. Kearsley, 1988), explored the link between self-efficacy and administrative computer use (e.g. Nash and Moroz, 1997), and analyzed computer training programs for school administrators (e.g. Bozeman and Spuck, 1991). However, thus far, research has left unquestioned the relationship between administrative problem solvers' thinking and use of the computer.

Conceptualizing educational leaders "as problem solvers and problem finders with varying levels of expertise" (Leithwood, 1995, p. 118) provides more than a practical notion of the day-to-day work of school administration. A problem-solving perspective on school leadership also focuses our attention on

Journal of Educational Administration
Vol. 41 No. 2, 2003
pp. 143-157

0957-8234
DOI 10.1108/09578230310464657

the thought processes underlying administrative behavior. Consequently, when applied to administrative computer use, such a perspective has the potential to increase our understanding of how school leaders think about and act on the instructional and administrative potential of digital technology. This paper presents the findings of an in-depth, qualitative case study of one expert school administrator's problem-solving practice and his use of computer technology within that practice. In doing so, the study aims to understand not only the potential of information-age technology to support administrative practice, but also the relationship between how an expert school leader thinks and how he builds and employs technological capacity.

We begin this exploration by briefly reviewing the research on expert administrative problem solving. We then present the literature surrounding administrative computer use, beginning with its short history and concluding with what the research tells us about the necessary competencies for and perceptions related to administrative technological expertise. After a review of the methodology, we move to our discussion of the data and the emergent conclusions.

A problem-solving perspective on school administration

In recent years, problem-solving perspectives on school leadership have gained significant theoretical ground. In particular, the research by Leithwood and his colleagues, on the nature and development of expert administrative practice, advances the notion of educational administration as problem-solving aiming to understand the integral link between thinking and practice. Positing that "what administrators do depends on what they think" (Leithwood and Steinbach, 1995, p. 94), Leithwood and colleagues apply a cognitive-science approach to problem solving, defining expertise in terms of problem-solving processes and employing those processes as a lens through which expert administrative practice may be understood.

From the research by Leithwood and his colleagues emerges a comprehensive framework for understanding the work of school leadership and how school leaders think about and within the situations they face. The framework offers valuable information regarding such aspects of administrative problem solving as the nature of problems faced by school leaders (e.g. Leithwood and Steinbach, 1995), the central elements of the problem-solving process (e.g. Leithwood and Stager, 1989), processes used by individual administrators when solving problems in groups (e.g. Leithwood and Steinbach, 1994), and the role of values and mood in administrators' problem-solving practices (e.g. Begley and Leithwood, 1989). Moreover, the framework links expertise to several constructs associated with transformational leadership, in particular to the expert's use of collaborative problem solving as a valuable tool for "generating better solutions, greater commitment, and long-term staff growth" (Leithwood and Steinbach, 1994).

The utilization of computers in educational administration

The brief history of computer technology in educational administration began in the 1950s when a limited number of large school districts, colleges, and universities invested in data-processing machines to perform such routine tasks as accounting, payroll, and financial reporting (Bozeman and Spuck, 1994). Over the next two decades, "the combination of more sophisticated users, better understanding of the relationship between information and decision-making, more powerful hardware, and improved software" (Bozeman *et al.*, 1991, p. 65) advanced the use of computer technology in educational organizations. During the early 1980s, as the wonders of digital technology came home in the form of the IBM and Apple Macintosh microcomputers, a new generation of technologically savvy citizens discovered a powerful tool for generating and managing stores of information. Simultaneously, electronic games captured youth interest and imagination, advancing technological skills such that increasing numbers of students came to school computer literate. As a result, the computer industry began marketing their products to schools (Picciano, 1998).

Alarmed by reports of declining achievement test scores, concerned parents looked to technology for solutions, while interested citizens urged school boards to purchase classroom computers in hopes of reforming an educational system judged at risk in maths and science (Bozeman and Spuck, 1991). Voter pressure caused by growing concern about "the inefficiency of US schools in producing ...workers flexible enough to survive in a rapidly changing workplace" (Cuban, 1986, p. 75) prompted politicians to join in the push for technology-rich education. Before long, schools began to make significant investments in computer technology, due, in part, to the "efforts of a handful of teachers and administrators who ...experimented with their own classes and schools ...[and] gradually won over more colleagues" with whom they "toiled to win political support and funding for technology" (Trotter, 1997, p. 7). While teachers moved forward with plans to technologically enhance instruction, principals and superintendents began to consider the application of microcomputers to administrative responsibilities.

Administrative competencies and perceptions

As mentioned, while a majority of today's school administrators recognize the computer's capacity to efficiently process information, they do not possess the expertise necessary to effectively utilize computer technology. According to the research, in addition to the three skills most frequently associated with computer competence (word processing, database, and spreadsheet), technologically adept administrators should be able to apply the computer to tasks associated with facilities management, financial reporting, scheduling, communications, and forecasting enrollments (e.g. Bozeman and Spuck, 1991; Kearsley, 1988). Administrators also should possess knowledge of and/or skill

in emerging technologies, planning for computer implementation, supporting instruction with technology, and facilitating and designing appropriate staff development (Thomas and Knezek, 1991). And, in an effort to increase their schools' computer capacity, technologically competent administrators seek out funding sources for technological growth (Kearsley and Lynch, 1994), guarantee appropriate facilities for computer technology, ensure equal access to computers, and provide adequate release time for teacher training.

The research also suggests that administrators who effectively implement computer technology may possess certain attitudes and beliefs. Evidence suggests that these administrators hold five, general perceptions about computer use. They:

(1) believe in the computer's capacity to effect meaningful educational reform (Kearsley and Lynch, 1994);

(2) develop and articulate a vision of how technology can help achieve educational goals (Bozeman and Spuck, 1991; Kearsley and Lynch, 1994);

(3) believe that data are a valuable decision-making resource (Bozeman *et al.*, 1991);

(4) believe that computer technology can support communication (Kearsley and Lynch, 1994; Trotter, 1997); and

(5) believe in their own capability to use the computer to complete required tasks.

In all, the literature regarding school administrators' perceptions about computers seems to suggest that administrative beliefs and attitudes influence administrative computer utilization – that the ways in which school leaders think about computer technology may determine their effectiveness as instructional technology leaders and administrative technology users. Yet, how a leader thinks involves more the content of thought, the manner of thought, the cognitive processes that create the cognitive and behavioral product. Insomuch as a problem-solving perspective has the potential to increase our understanding of processes leading to expert administrative behavior, we move now to a discussion of our case study.

Method of inquiry and analysis

The research design selected for this study is the instrumental, single case study (Stake, 1994). Case study is particularly useful "where one needs to understand some special [person], particular problem, or unique situation in great depth, and where one can identify [a case] rich in information – rich in the sense that a great deal can be learned" (Patton, 1990, p. 54). Here, the choice to study an expert administrative problem solver was made because it is expected to advance our understanding of the effective application of computer technology to educational administrative problem solving.

The participant for this instrumental case study is the principal of an urban public high school. This educational administrator was selected purposefully (Patton, 1990) after his participation in a pilot study during which 11 participants were interviewed regarding their problem solving and use of computer technology. Using four indicators of problem-solving expertise (Leithwood *et al.*, 1992) as a filter for the data, our participant emerged as an expert administrative problem solver (Leithwood and Steinbach, 1994). Moreover, additional interview data about his use of the computer seemed to suggest that this expert problem solver was also an efficacious user and capacity-builder of computer technology. His selection was enhanced by the fact that he practices in a large, urban school district where access to computer technology typically is not unlimited.

In an effort to triangulate data sources, this case study utilized three qualitative data-collection methods: interview, observation, and document analysis. Once collection was complete, the raw data from nearly 90 hours of engagement (over an 11-month period) were organized and transcribed. The investigators applied a qualitative, thematic strategy of data analysis making inferences by systematically identifying specified characteristics of text units, searching for emerging categories as well as teasing out anomalies and contradictions across the data. Thirty individual problems were hand-coded employing themes emanating from the literature and the data themselves such as steps in the problem-solving process, information gathering and use, cognition, building relationships, and cultivating change. Finally, issues of internal and external validity, reliability, and objectivity were addressed through parallel qualitative criteria: credibility, transferability, dependability, and confirmability (Guba and Lincoln, 1989).

The study of an information age problem solver

Given the significance of problem solving and problem finding in school leadership, and of the potential of computer technology to support these processes, there is much we can learn from a school leader who possesses the necessary knowledge, skills, and technological capacity. Hence, this qualitative analysis begins by introducing the expert whose administrative problem-solving practice is at the center of this analysis and, through a brief description of his school, the setting within which he works. In light of this information, our discussion of the data then focuses on how this school leader thinks about and acts on the problems he faces, in particular, the problem of creating technological capacity and how that thinking influences his administrative use of computer technology.

The problem solver

Mark Davidson is the principal of Evans Local Education Center (ELEC), an urban alternative arts and academic high school and career center located

within a large, Midwestern, public school system. Before earning his doctorate in educational administration, Davidson served as an instrumental music teacher and band director for 11 years. In 1988, with three years of administrative experience, Davidson was charged with creating ELEC by melding an already established career center with a new arts and academic high school program. In Mark's words, "[the assistant superintendent] just took the keys, pushed them across the desk to me, and said, 'It's your school. Make it happen.'"

As mentioned, Mark Davidson emerged as an expert educational administrator during a related pilot study. Davidson's skills, knowledge, and record of accomplishment established his qualification as an expert. By definition, a problem-solving expert possesses, among other qualities, the ability to perceive meaningful patterns within his or her domain and represent problems at a deeper level. Staff comments emanating from the current study seem to offer further support for his identification as an expert problem solver and instructional leader. Here, a teacher summarizes his impression of Davidson.

> He involves the teachers when it's a teacher thing, and if it's an administrator thing, he takes care of the problem. . . .He intervenes and sometimes you never hear about it. I see him as kind of like a guard for the door into a lot of problems.

According to the teacher, Mark is adept at finding and solving problems, often before they occur. He employs his problem-solving expertise as a shield to protect his staff from unnecessary disruptions. And, Mark knows when to solve problems collaboratively and when to work alone.

The problem-solving setting

As mentioned, ELEC is an urban alternative arts and academic high school and career center. Once a military base dating from the Civil War, ELEC's 62-acre, six-building campus is situated in a downtown area of the state's second largest school district, surrounded by industry, freeways, and a community college. The faculty includes an administrative team comprised of one principal, two assistant principals, two supervisors, and a teaching staff of 70, 57 percent of which have earned advanced degrees, and 64 percent of which bring to their practice 14 or more years of teaching experience.

Each year, interested students from the local district apply for the 180 ninth-grade, arts and academic high school openings and are selected by lottery in numbers reflecting the cultural diversity of the school district. Students interested in the career center apply for programs for their junior and/or senior years, attending ELEC for half of a day and their home high school for the other. With regard to student achievement, ELEC's graduation rate is 95 percent, significantly higher that the district's 57 percent and the state's 80 percent rates. The percentage of graduates going on four-year colleges and universities is 64 percent, as compared with the district average of 48 percent,

and an additional 14 percent of graduating ELEC students attend two-year programs. All areas of the ninth and twelfth grade state proficiency scores are above district and state averages, with most areas showing improvement over the past three years.

Solving the problem: a proactive, strategic, and collaborative approach

As education advances into the information age, increasing numbers of school administrators face the challenge of technologically equipping their schools. In large urban school districts, where outdated facilities and the lack of funding present formidable constraints, building and sustaining computer capacity can be problematic. Such was case at ELEC when Mark Davidson opened a new school within such a resource-scarce environment. Yet, despite the barriers, Davidson has succeeded in building and effectively employing computer capacity at ELEC. As Mark explains, "It's no secret in the district. If you ask where [technology's] happening, they're gonna tell you it's here."

Our analysis of the data surrounding Davidson's quest to build computer capacity seems to suggest that Davidson thinks about and acts on building computer capacity in much the same way as he thinks about and acts on the other problems he faces. He devotes significant time up front to understanding the problem, establishing agreed-on goals, and crafting a solution. As constraints emerge, he considers each in the context of larger goals, reframing them as opportunities to advance the plan. And, in retrospect, he reflects on outcomes as they inform his thinking and actions on future problems. Moreover, the data suggest that Mark Davidson's thinking and actions reflect a decidedly proactive, strategic, and collaborative approach. Mark devotes significant effort to discovering potentially problematic situations and strategizing plans to avert problems before they occur. Says a teacher, "He sees future problems and [resolves] them. He knows things that are coming up, and he's on top of it. He gets involved in things he knows would be good for the school." And, when appropriate, Davidson engages organizational members in collective thinking and action. Says another teacher, "He fosters the team approach and encourages staff to give their options for the decision-making process."

A proactive approach to building capacity

Mark's forward thinking has played a substantial role in the growth of technological capacity at ELEC. Framing the problem as a gap between ELEC's actual and possible levels of computer capacity, Mark blends knowledge, experience, and proactive thinking into a guiding vision of administrative and instructional computer use. Says Davidson, "I think I see where the future's going [with computer technology] and my obligation to students is to get them there as quickly as possible."

A case in point emerges from ELEC's initial steps toward technological growth. Guided by his formulation of the problem, Mark approached the assistant superintendent about upgrading the cable being laid at ELEC for a different, district-wide project. Suggested Davidson, "If you're going to lay fiber, give me four extra strands. Give me 12-strand cable. You've already got the holes open . . .if nothing else, it gives me back up. It's looking to the future." Although, at the time, ELEC lacked the necessary computer capacity to utilize the upgraded cable, Davidson seized the opportunity, in light of his goal, to begin creating an infrastructure for the future. An assistant administrator discusses the impact of Mark's problem-solving expertise on the technological capacity they now enjoy.

> This is his foresight. Years ago he had this place wired – fiber optics. He had this place trenched and dug, and we were ready when everybody else [was unaware of the need for upgraded wiring]. He knew this. I didn't know. Nobody knew it.

Davidson's ideas about the future of computer technology at ELEC took shape over the course of his own journey toward gaining computer capacity. Mark was introduced to the personal computer during his graduate work in the early 1980s while, as an administrative assistant for the university's school of music, Davidson was encouraged by a colleague to learn to use the computer for word processing. "I started using this thing. Nobody in the school of music had one, but [my colleague], and he allowed me to use it." Recognizing the capability of computer technology to support his work, Mark invested time to teach himself about the computer. Some months later, as Mark explains, "[My colleague] and I . . . decided to write a software program [for scheduling the music school's facilities] which I'm still using today, here, scheduling this whole campus." By blending his growing awareness of the computer as an administrative problem-solving tool with his knowledge of scheduling to craft a technological solution, Davidson began to realize the potential of computer technology to solve problems of practice.

On completing his degree, Mark took a position as an assistant high school administrator. As he explains, "I saw the handwork with attendance. I couldn't believe all the paper, so I started asking, 'Why couldn't we do this on the computer?'" Davidson continues. "Lo and behold, [someone from the district contacted me] saying, 'We're looking for a pilot school for an attendance program. We know you're interested in technology. What do you think?' I said, 'I'll do it!'" Before long, the district brought in "all the terminals we needed . . . and we started to apply it." As Mark's reputation as a technologically savvy school leader grew, so grew his capacity to build capacity.

Davidson's burgeoning knowledge of the computer's administrative potential influenced his thinking and actions regarding the role of technology in student achievement. Having experienced first hand the capability of word processing to enhance the writing process, as the newly

appointed principal of ELEC, Mark encouraged a technological solution to an instructional problem.

> English teachers would tell me, "We could get these kids writing better if they didn't have to rewrite." I said, "If we get computers, they could cut and paste." So, I put in a grant for a writing lab and it got funded. . . .As soon as they got the kids in there, they started to realize [how the computer could help] because all these kids wanted to redo [their work].

That grant led to another for a visual arts lab, and, as the wave of technological interest spread across ELEC, other computers were acquired. Davidson explains,

> It just started to grow because people could see that [the computer] was a tool to get work done at a higher level of excellence. You just get [the computers) to [the teachers]. They'll run with it. You nurture and take risks.

Thus, Mark's vision, both process and product of his proactive problem solving, provides the catalyst for building technological capacity at ELEC.

A strategic approach to building capacity

In addition to thinking and acting proactively, Davidson's problem solving on behalf of computer acquisition and use is strategic. Understanding that ELEC's technological growth rests on staff members' perceptions of and competency with the computer, Davidson employs professional development as a capacity-building strategy. Here, a veteran ELEC administrator describes how Mark presented her with the challenge of computer literacy and supported her along the way.

> When I came here, I had never used a computer. From the very beginning he said, "You gotta learn." Year after year that was on my evaluation . . .and I learned it, but I didn't think I could. He has continued to challenge the staff and to use the technology and be on the cutting edge and to provide, whenever he can, the equipment they need.

In addition to professional development, Davidson strategically employs teacher interest to grow technological capacity. After attending a nearby university's presentation of a computer application for teaching calculus, Mark recognized its instructional potential and shared the idea with his math department chairperson. Consequently, as the chairperson explains, "I kind of saw how [the application] would work, and we started it – this is the fourth or fifth year we've done it. It's grown, and I've learned how to do it better." Regarding Davidson's role in promoting teacher interest, the chairperson contends, "He's out there looking for things, and if he sees something, he doesn't demand it. He never demanded that I do it. I took it on myself, but he presented the fact that it existed." Here, the marriage of interest and opportunity resulted in growth. Davidson expounds.

> When you know what folks are interested in, help them get to where they're self-realized. He has this great knowledge, . . . and every time he's learning and doing, he's helping our kids. So turn these people loose, don't stifle them, make opportunities for them.

A collaborative approach to building capacity

In combination with his proactive and strategic approaches, Davidson is collaborative in his efforts to grow technological capacity. Davidson involves staff and the larger school community in collaboration around a shared vision of ELEC's technological future. As Mark explains, "If everyone's involved in the solution, then it's going to be long lasting. If it's by compliance, as soon as I walk away, the problem is still there."

A particularly cogent example of Mark's use of collaboration to build capacity emerges from two, consecutive, monthly in-service meetings designed to engage the faculty in designing the technological future of ELEC. Across these two meetings, Davidson proactively and strategically guides staff members through collaborative discussion around the following provocation: "Over the next ten years, what programming and staff behaviors, both personal and professional, are required to increase student achievement, develop a complete graduate, and advance Evans Local?" He begins the discussion by introducing the problem and the process toward its solution.

> This is a session, as the objectives clearly say on your agenda, for thinking about the future. This is time to dream. It's time to put some of those thought processes on paper and see what may or may not happen. [This] is not an exercise. This is work, a beginning to defining our future.

Next, after Davidson presents the five areas of future development emerging from a list of faculty priorities (curriculum/interdisciplinary, assessment, career/service learning, professional development, and communications/public relation), he engages staff members in proactive dialogue aimed at infusing each area with computer technology. Mark strategically designs collaborative problem-solving sessions, composing the focus of discussion, the group's size and composition, and the problem-solving processes they will undertake. In doing so, Davidson provides the opportunity for staff members to interact and share their knowledge, enriching individual practice and the organization's understanding of instructional computer technology.

As mentioned, Davidson engages not only staff members, but members of the larger, school community in collaboration. Mark sees himself as the facilitator of ELEC's technological growth, "supporting it, garnering the resources and the manpower to get the work done." Consequently, Davidson seeks to connect surrounding industrial, cultural, educational, and civic organizations to ELEC in ways that support his vision of technological capacity. Mark explains.

> Around 1989, when we were looking at how to connect this school with the neighborhood, a reporter called about the school because it was [unique]. I said, "We don't have a school in a conventional neighborhood. So what I really need right now are people – sort of like Mr Rogers – won't you be my neighbor?"

A few days later, a story about ELEC appeared in the local metropolitan newspaper with the title, "Won't you be my neighbor?"

> People started calling saying, "I'll be your neighbor." That led us to seeking a grant from the state department of education for community connections, and that led to reaching out into the community and saying, "OK, what makes up a neighborhood and who do we need here to help us?"

This led to the formation of the Evans Local Advisory Board, comprised of local business, design, and legal professionals. Since its inception, the advisory board meets bi-monthly to address ELEC's long-range planning needs. "People fail to realize that a lot of hard work overcomes what you don't have as you try to collect and organize those resources." A veteran teacher agrees.

> Mark's really reaching out to them. I think people want to be supportive in the business world, [but] often they're not asked, and they don't know what role to play. I think we've been able to provide – and certainly Mark's direction on this – an outlet for people who want to feel they're contributing.

Clearly, Mark's strategic efforts to forge alliances with local organizations have generated invaluable resources for growing technological capacity. Early on, when computer capacity at ELEC was limited to the career program's data-processing equipment, Davidson turned to his community partners for help in acquiring hardware, one of which donated used computers to Mark's commercial arts program. Similarly, a few years later, community partner Ameritech approached Davidson about Evans serving as the hub location for a distance-learning program. As a hub, ELEC would acquire the necessary upgrades to provide and access online student and staff demonstrations of digital audio, video, and multimedia projects. Not surprisingly, Mark jumped at the chance to increase the school's capacity, to enrich the education of students and teachers, and to contribute to the broader knowledge base through what he calls "research and development." Thus, in cooperation with career centers across the metropolitan area, the distance learning lab became a reality, and Davidson gained the capability to digitally connect his students with teachers and classrooms across the country.

The influence of attributes and perception on computer capacity building

According to research, efficacious administrative computer users are not only technologically knowledgeable and proficient, but are also capable managers of computer technology within their schools (Bozeman and Spuck, 1991). As demonstrated, Mark Davidson appears to possess this knowledge and proficiency as well as the necessary management skills. Research also contends that effective computer users demonstrate certain perceptions related to that use (Bozeman and Spuck, 1991; Kearsley and Lynch, 1994). Our analysis of the data further suggests that Davidson possesses all five of the general beliefs outlined earlier. First, Davidson appears to believe that the computer can effect meaningful educational change. His ongoing efforts to build computer capacity, to develop a technologically infused curriculum, and to encourage the computer

literacy of staff suggest that he perceives the computer as a powerful tool for transforming schools. Second, Davidson develops and articulates a vision for instructional computer technology. His vision of ELEC's technological future, born of knowledge gained through experience, guides ELEC's ongoing efforts to technologically enhance the curriculum. Third, evidence clearly suggests that Davidson views data as a valuable decision-making resource. Faculty feedback supports the conclusion that Mark is, as one staff member puts it, "an information gatherer." Fourth, Davidson seems to believe that computer technology can support communication. His extensive use of word processing for written communication and his burgeoning use of the Internet and e-mail are indicative of such a perception. As Davidson explains, "The computer allows me to access information, to drop things in, come back to it, re-edit, rewrite ... and I can come up with a better product." Last, Davidson possesses a strong sense of computer self-efficacy. As he explains,

> I'm very comfortable with [e-mail] now and what it can and can't do. I sent a survey out [to other administrators], and they're pounding me back with e-mail responses. I sent out the communication inviting [a district official] to a meeting, and we communicated the whole piece [via e-mail] – we never did talk on the phone.

Clearly, these attributes and perceptions play a substantial role in Davidson's acquisition and use of computer technology. Yet, given our broader understanding of this expert, it becomes quickly apparent that the scope of influential attributes and perceptions extends beyond those directly related to computers, to those emerging from Davidson's practice as an expert administrative problem solver. Davidson's continual efforts on behalf of school improvement indicate a comfort with change, change that necessarily accompanies the computer's application within instruction and administration. Mark's strategic thinking and forecasting facilitate his vision of computer technology and the planning required for its implementation. Davidson's desire to create learning opportunities for students and staff positions the computer as a support tool for teaching and learning. His focus on collaboration results in richer, more interdisciplinary plans for implementation and promotes the likelihood of equal access across the disciplines. And, the relationships Mark has built between school and community continue to foster the growth of computer capacity at ELEC.

In sum, the influence of personal attributes and perceptions on computer use seems to be located at the intersection of computer-related attributes and expert administrative practice. Said another way, Davidson's overriding belief in the educational promise of computer technology, his technological competence and use, his effort to build a school culture conducive to change, and his school's alliance with the larger community, together, have advanced a vision of computer technology and the capacity to support it.

Implications for leadership preparation

From the study emerge two considerations for the preparation of educational administrators. First, given the apparent connection between expert thinking and building technological capacity, this research suggests that a problem-solving perspective on the preparation of school leaders might prove advantageous. Conceptualizing educational administration as a decidedly cognitive endeavor emphasizes the need to prepare school leaders to think and act proactively, analytically, and strategically. Toward this end, preparation programs would do well to immerse aspiring administrators in the problem-solving process, providing students instruction and practical experience aimed at developing strong thinking skills. Across the curriculum, coursework should emphasize information gathering, finding and making sense of emerging themes and patterns, formulating problems, developing and testing hypotheses, and reflecting on outcomes as it challenges students to apply these cognitive tasks to a variety of problematic situations. Also, embedded within each course, field experiences should provide students with multiple and prolonged opportunities to identify and wrestle with their own problems of practice, adding immediacy and context pushing students to employ their cognitive skills proactively, analytically, and strategically. Moreover, in light of the connection between collaborative thinking and creating capacity, students should learn how to extend these cognitive skills to the collective by using collaborative problem solving to create, employ, and sustain relationships between and among school community members on behalf of organizational growth.

Second, computer education programs for educational administrators should be reconsidered. Current administrative computer courses tend to focus on skill development as it relates to specific computer applications. Such software-based instruction, although helpful for increasing literacy, provides little opportunity for administrators to apply their newly gained skills to the real-life problems they face. In fact, some suggest that the time has come for preparation programs to "expect that students, on entrance to a program, demonstrate a basic understanding of computer operation and application and the application of computers to instruction" (Bozeman and Spuck, 1991, p. 525).

This study positions educational administrators as problem solvers and problem finders (Leithwood, 1995). If, as suggested, the computer can support administrative problem solving, we need to rethink current notions of computer competence. In light of increasing calls for accountability, administrators would benefit from courses aimed at using the computer as a tool for information-based decision making. Such coursework would position data as crucial to the problem-solving process, identifying various technologically available information sources and means for using the computer to access, make sense of, present, and communicate data. Further, given the focus of coursework on problem solving, problem-based instruction might prove

beneficial. As students endeavor to resolve authentic problems, they would discover ways to employ the computer as a support tool. And, woven within problem-based coursework, discussion would address other pertinent topics emerging from the study such as using the computer to support the range of leadership roles; becoming a leader of computer technology; cultivating change through computer technology; decision making about computers in schools; building computer capacity within schools; the limitations and possibilities of computer technology; staff development issues; and using the computer to support individual and collective problem solving.

From this perspective, administrative computer competence would be more than application-based skill. It would be the ability to interpret the problematic situation and, in light of the administrator's knowledge of computer capabilities, craft a solution using the most appropriate tools. As the research suggests, problem-solving expertise and the expert use of computer technology are closely linked. Such a notion implies that the more we offer administrators authentic yet risk-free opportunities to practice using the computer, the more likely they are to confidently and effectively employ the tool.

Conclusion

The information age is upon us. In schools across the country, administrators are making important decisions about how best to employ computer technology. This case study of an expert educational administrator looks at computer use from a problem-solving perspective, focusing on the relationship between how this school leader thinks about and acts on technological capacity. It presents this expert administrator's problem-solving practice as proactive, strategic, and collaborative and locates his acquisition and use of computer capacity solidly within that practice. It examines the personal attributes and perceptions that underlie his effective application of technology and finds them interwoven with the same cognitive and behavior skills he employs across his problem solving. It explores the connections he makes between school and community, between administrative and instructional technology, and between computers and student achievement. And, as a result, it concludes that the connectedness of his thinking, his capability to see and act on relationships within and among the problems he faces, in large part, explains his success connecting vision with its realization.

References

Begley, P. and Leithwood, K. (1989), *The Nature and Influence of Values on Principals' Problem Solving*, Ontario Institute for Studies in Education, Toronto.

Bozeman, W.C. and Spuck, D.W. (1991), "Technological competence: training educational leaders", *Journal of Research on Computing in Education*, Vol. 23 No. 4, pp. 514-29.

Bozeman, W.C. and Spuck, D.W. (1994), "Computer support for administrative leadership of schools", in Kearsley, G. and Lynch, W. (Eds), *Educational Technology: Leadership Perspectives*, Educational Technology Publications, Englewood Cliffs, NJ, pp. 39-50.

Bozeman, W.C., Raucher, S.M. and Spuck, D.W. (1991), "Application of computer technology to educational administration in the United States", *Journal of Research on Computing in Education*, Vol. 24, pp. 62-77.

Cuban, L. (1986), *Teachers and Machines: The Classroom Use of Technology Since 1920*, Teachers College Press, New York, NY.

General Accounting Office (1995), *School Facilitites: America's Schools Not Designed or Equipped for 21st Century*, USGAO, Washington, DC.

Greenfield, W.D. (1995), "Toward a theory of school administration: the centrality of leadership", *Educational Administration Quarterly*, Vol. 31 No. 1, pp. 61-85.

Guba, E. and Lincoln, Y. (1989), *Fourth Generation Evaluation*, Sage Publications, Newbury Park, CA.

Kearsley, G. (1988), "What should today's school administrators know about computers?", *T.H.E. Journal*, Vol. 15 No. 3, pp. 65-9.

Kearsley, G. and Lynch, W. (1994), *Educational Technology: Leadership Perspectives*, Educational Technology Publications, Englewood Cliffs, NJ.

Leithwood, K. (1995), "Cognitive perspectives on school leadership", *Journal of School Leadership*, Vol. 5, pp. 115-35.

Leithwood, K. and Stager, M. (1989), "Expertise in principals' problem solving", *Educational Administration Quarterly*, Vol. 25 No. 2, pp. 126-61.

Leithwood, K. and Steinbach, R. (1994), *Expert Problem Solving*, State University of New York Press, Albany, NY.

Leithwood, K., Begley, P. and Cousins, B. (1990), "The nature, causes, and consequences of principals' practice: an agenda for future research", *Journal of Educational Administration*, Vol. 28 No. 4, pp. 5-31.

Nash, J.B. and Moroz, P. (1997), "Computer attitudes among professional educators: the role of gender and experience", paper presented at the *Annual Meeting of the Southwest Educational Research Association*, Austin, TX, January.

Patton, M.Q. (1990), *Qualitative Evaluation and Research Methods*, 2nd ed., Sage, Newbury Park, CA.

Picciano, A.G. (1998), *Educational Leadership and Planning for Technology*, Prentice-Hall, Saddle River, NJ.

Stake, R.E. (1994), "Case studies", in Denzin, N.K. and Lincoln, Y.S. (Eds), *Handbook of Qualitative Research*, Sage, Thousand Oaks, CA, pp. 236-47.

Thomas, L.G. and Knezek, D. (1991), "Providing technology leadership for restructured schools", *Journal of Research on Computing in Education*, Vol. 24, pp. 265-81.

Trotter, A. (1997), "Taking technology's measure", *Education Week*, available at: www.edweek.org/sreports/tc/intros/in-n.htm

Further reading

Spuck, D.W. and Bozeman, W.C. (1988), "Training school administrators in computer use", *Journal of Research on Computing in Education*, Vol. 21 No. 2, pp. 229-39.