Best practices in information technology (IT) management: insights from K-12 schools’ technology audits

Steve O. Michael
Associate professor of educational management and director of the doctoral program in higher education administration at Kent State University, Ohio, USA

Introduction
The Rt. Hon. Tony Blair MP (Blair, 1996) observed that:

“Education is about investing in our future; and it is in the marriage of education and technology that the future lies for Britain. Young people now in school will emerge into a world dominated by information and communication technology. The developments in these fields are phenomenal: the Internet, almost unheard of only two years ago now has an estimated 70 million users worldwide; with over 7 million PCs in businesses in Britain, being able to use a computer at work is already as important as being able to read and write” (p. 1).

The increasing integration of technology and education is phenomenal and offers much promise not only to Britain, but the US and other developed and developing nations. In the US, President Clinton (1996) remarked that:

“Technology is clearly transforming our world, and it is creating a range of possibilities for the young people behind me and the young people in this audience that are literally unimaginable. Many of you people who are [university] students... and the younger students from high schools and the middle schools and the elementary schools, you will be doing work that has not been invented yet. Some of you will be doing things that have not even been imagined yet. And it is up to us to see that every one of you has the best possible chance to develop your talents and to live out your dreams... What does this mean, hooking up every classroom? It means if you have the right computers and the right education equipment, software, the right educational software and properly trained teachers, and then all of these connections are made to the Internet and the World Wide Web and all of the other networks that will be exploding out there, think what this means. This means for the first time ever in history, children in the most rural schools, children in the poorest inner-city school districts, children in standard middle-class communities, children in the wealthiest schools, public or private, up and down the line, will have access in real time to the same unlimited store of information. It will revolutionize and democratize education in a way that nothing ever has in the history of this country. Think about what it means.”

Indeed, in the minds of national leaders, the potentials and promise of technology to their educational efforts are enormous.

Consequently, many of these leaders are making significant investment in information technology (IT). According to US Government papers, over $26 billion was obligated for information technology in 1996 and “this IT spending represents a critical investment of public tax dollars affecting virtually every government function” (http://www.whitehouse.gov/WH/EOP/OMB/infotech/infotech). In 1995, the state of California alone allocated over $250 million to “schools on a one-time basis to purchase such items as computers...” (See: www.fwl.org/technology/legupaug.html).

Yet, Detwiler Foundation (1997) remarked that: California currently ranks 50th in the nation in the ratio of students-to-computers. Students in California get less computer exposure in school than students anywhere else in the nation! On average, computers in elementary schools are older than the students. Less than half (48%) of the computers currently being used in schools have hard drives. Schools average 39 students for every computer with a hard drive.

However, the realization of these potentials and promise in schools depends much on achieving appropriate organizational change and strategic leadership that will ensure IT effectiveness in schools.

But implementing IT in schools is like navigating in uncharted waters. Few, if any, of the current top school leaders had computer training during their graduate education. Few of today’s school leaders have access to scholarly literature that addresses the leadership dimension of IT in schools. Most of the writers on IT in schools have focused primarily on integration of computers to classroom instruction. Consequently, leaders have few options or models to guide their IT initiatives.

The purpose of this article, therefore, is to present a model of best practices that can be useful to school management/administration in either developing and implementing an IT plan or evaluating an existing IT plan. The central goal of this article is to help school leaders who are interested in answering this
imported question: “So how is my school organization doing with regards to IT implementation?” In an increasingly competitive environment, school leaders must be concerned about how IT is being utilized in their schools as compared with other schools and, more importantly, as compared with insights of IT best practices in the school sector.

Background information
The search for best practices is not limited to IT in schools. Almost every field of study and every profession has some form of principles of best practices. The Center for Advanced Purchasing Studies (CAPS), for example, defined best practices for their field as “the identification of policies, procedures, and programs, referred to as the critical success factors, that top performers are using that lead to superior performance” (Caps, 1997). The business sector usually identifies top performing companies (with criteria ranging from level of profitability, relative growth to position within the industry) and strategies found common among these companies have typically provided a framework for developing insights about best practices.

Several Web sites have been developed to provide information regarding best practices in education. For example, Drummond’s Web site provides best practices in college teaching (see: www.nscucx.scc.ctc.edu/~eceprog/bst-prac.html). Similarly, Chickering and Gamson’s Web site provides seven principles for good practice in undergraduate education (see: www.hcc.hawaii.edu/hccinfo/facdev/7_principles.html).

Some writers have argued against the notion of best practices because these practices are often conceived to offer a prescription or pretension of ultimate excellence and to the extent that the environment is changing as well as human knowledge, attempts to offer the final words on best practices should be viewed as dubious. For example, in an article entitled “The myth of best practices,” Strassmann (1995) concluded that:

Excellent companies can achieve superior performance without following any standard information technology spending pattern. I base this conclusion on my analysis of the budgets of Computerworld’s Premier 100 companies over a two-year period. These are organizations whose information productivity is superior to other US corporations. (p. 1)

However, there is overwhelming information to support basic principles of practices common with high performing organizations in spite of differences in their tactical approaches. According to the US Government, “there are some overall organizational attributes that are critical to successful investment evaluation. These shared, critical attributes are: senior or management attention, overall mission focus, and a comprehensive portfolio approach to IT investment (1998, p. 3). A school leader (1994, p. 5) in the UK describes their national objectives for IT in schools:

(1) learning activities make effective use of the most up-to-date technology; (2) the school curriculum reflects the use of IT outside school, takes account of the developing IT capability of pupils, takes advantage of information resources made available by IT; (3) school managers and governors fully understand the implications of the extensive and changing use of IT in the curriculum; (4) all teachers know how IT may be used to improve learning; (5) all teachers are capable of using IT resources and applying them effectively; (6) all parents recognize the educational benefits of IT; (7) all schools are well-resourced and able to give their pupils and teachers appropriate and adequate access to IT; (8) access to IT is adequate to make possible learning outside school for everyone and enable such learning formally to be recognized whenever appropriate; (9) school management uses IT efficiently and effectively for administration; and (10) all schools regularly evaluate the impact of IT on standards, the quality of learning and the quality of teaching. (p.5)

Indeed, these insightful objectives could only have been derived from a good understanding of the nature of teaching and learning and the appropriate IT practices in schools.

Methodological approach
There are, perhaps, many ways of arriving at the principles of best practices. As mentioned earlier, the most common approach in the business sector is to identify the most successful or top performing organizations within a particular industry and attempt to identify principles of operation that are common to these organizations. However, this approach is unsuitable for IT in schools because most schools are still at the experimental stage with their IT implementation and also because of the rapid changes taking place within the IT industry itself. A more appropriate approach (an indirect approach) used for this project examined IT implementation strategies in various school organizations with the sole purpose of deriving insights of best practices.

As part of the requirements of a graduate class in microcomputers for school administrators, over 100 graduate students had participated in training (under the author of this article) that enabled the students to conduct IT audits in school organizations, analyze data collected, and provide individualized reports on the findings. The data collection involved direct observation (including actual inventory of hardware and software
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Access rate

Access to IT is perhaps the most fundamental of all IT goals. Traditionally, access is viewed as simply the ratio of computers to users but, as indicated in this model, access is best defined as the extent to which users are able to lay hands on functioning hardware when needed. The mere presence of computer hardware does not automatically result in access; hence, the need to identify the problems associated with access.

The criteria used to determine access rate, of course, include the ratio of computers to users. A high ratio of computer hardware to users would suggest high accessibility. For example, accessibility ought to be higher at a school with 10:1 pupils to computer ratio than a school with 30:1. One may be tempted to view a ratio of 1:1 pupil to computer as the ideal scenario, but as long as there are non-computer-related educational activities in schools, schools’ needs for computers do not warrant this level of investment. Indeed, over-computerization (the level at which computers lay idle, whereby supply outweighs demand) is an inefficient investment practice. The second criterion involves the ratio of output devices to input devices. Whereas every computer may not have its own printer, adequate output devices should be available to support the volume of output jobs required by users. Lastly, accessibility must be defined to include the location of the hardware for all users. Consequently, the extent to which the location is accessible to handicapped users, part-time, full-time, young and old students must be taken into consideration in determining the access rate for a particular school organization. A access rate, therefore, can only be measured by the number of users, the characteristics of these users, and the number and appropriateness of the computer hardware sets available. Therefore, it is advisable for access to be defined from the point of view of users rather than that of the service providers. Figure 1 describes hypothetical access ratios over a period of 10 years for a school that is making true progress in increasing access rate.

The ideal practice would be to graph (accessagram) the ratio of pupils to computer annually. With this practice, school leaders would be able to detect their school’s IT access trend and progress. The essence of these statistics is to observe improvement in access rate over time. An ideal IT practice would be to continue to record a declining number of problems (as perceived by users themselves) in users’ effort to access computer services. Each segment of the users (part-time, full-time, adults, etc.) should have its own accessagram.

IT leadership promise

Leadership promise is perhaps the least emphasized of all the elements of IT best practices. Understandably, for lack of technical knowledge, school leaders often shy away from providing the necessary IT leadership and thereby force the technical personnel to assume IT leadership without the necessary administrative powers. However, the most promising practice requires an effective IT leadership that is not limited to the technical people but that emanates from and embraces the school leaders themselves.

Model of best practices

Table 1 provides a summary of elements gleaned from studying IT practices in school districts within the north-east of Ohio, USA. These elements are defined and criteria for measuring their achievement are also provided.

<table>
<thead>
<tr>
<th>Element</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access rate</td>
<td>The extent to which users are able to lay hands on functioning hardware when needed.</td>
</tr>
<tr>
<td>IT leadership promise</td>
<td>Effective IT leadership that is not limited to the technical people but that emanates from and embraces the school leaders themselves.</td>
</tr>
</tbody>
</table>

Table 1: Summary of best practices elements.
For this purpose, leadership promise, as an element of best practices, is defined as the extent to which there is a clear visible leadership driving technological initiatives within the school system. Hitherto, in many schools, IT has evolved haphazardly in the absence of a proactive and integrative leadership.

IT leadership promise can be assessed through four measurable criteria. First, the extent to which leaders are computer literate is fundamental to their IT leadership. Technology has become an integral part of school operation and management and, from all indications, technology will continue to play a greater role in teaching and learning in the 21st century. Consequently, computer illiteracy among current and future school leaders is a serious dereliction of responsibility.

Informed school leaders understand simple computer concepts and terminologies and, while they need not be technicians, they can discuss intelligently with their technicians on all IT initiatives. In some of the leading schools where the IT audit was conducted, school principals and central administration personnel including the superintendents have adopted the practice of attending seminars and conferences relating to IT in schools on a regular basis.

Apart from being computer literate, leadership can also be measured in terms of the level of advocacy for full utilization of IT. More often than not, teachers and staff lag behind computer development and without a clear audible advocacy from the leaders, change in schools can be a very slow process. Advocacy is reflected in leadership commitment to IT implementation. In one of the interviews a superintendent, who was highly praised by his teachers as a great advocate of technology, commented that:

Table 1
A model of IT best practices in K-12 schools

<table>
<thead>
<tr>
<th>Factors</th>
<th>Definition</th>
<th>Measurable indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access rate</td>
<td>The extent to which users encounter problems in laying hands on functioning hardware</td>
<td>- Ratio of computers to users</td>
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<tr>
<td></td>
<td></td>
<td>- Ratio of printers to computers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Accessibility of computer locations to users</td>
</tr>
<tr>
<td>Leadership potential</td>
<td>The extent to which there is a clear visible leadership driving technological initiatives</td>
<td>- Level of leadership computer literacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Level of leadership advocacy</td>
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<tr>
<td></td>
<td></td>
<td>- Effective use of technology committees</td>
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<tr>
<td></td>
<td></td>
<td>- Effective administrative structure and authority</td>
</tr>
<tr>
<td>Technology planning</td>
<td>The extent to which technological activities and initiatives are driven by a proactive, systematic plan</td>
<td>- Comprehensiveness of the plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Collaboration in planning development</td>
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<td></td>
<td></td>
<td>- Continuity of the planning cycle</td>
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<tr>
<td></td>
<td></td>
<td>- Commitment to the plan</td>
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<tr>
<td>Staff development</td>
<td>The extent to which staff development stays ahead of technological innovations utilization</td>
<td>- Personalized staff development plan</td>
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<tr>
<td></td>
<td></td>
<td>- Incentive associated with staff development</td>
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<tr>
<td></td>
<td></td>
<td>- Continuous staff development opportunities</td>
</tr>
<tr>
<td>Technical support</td>
<td>The extent to which help is available</td>
<td>- The waiting time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The service quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The maintenance plan</td>
</tr>
<tr>
<td>Hardware and software</td>
<td>The extent to which the most appropriate technology is in use</td>
<td>- The effectiveness of procurement plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The compatibility of hardware and software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The effectiveness of system with instructional goals</td>
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<tr>
<td></td>
<td></td>
<td>- The compatibility of system with admin system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The effectiveness of a replacement plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Availability of discarding plan</td>
</tr>
<tr>
<td>Technology budget</td>
<td>The extent to which financial resources are available to meet technological goals</td>
<td>- The ratio of technology budget to the total budget</td>
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<tr>
<td></td>
<td></td>
<td>- The ratio of soft money to hard money</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The budget philosophy in use</td>
</tr>
<tr>
<td>Infrastructural facilities</td>
<td>The extent to which non-technology related facilities are available to support effective utilization</td>
<td>- Appropriateness of room conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Appropriateness of furniture</td>
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<tr>
<td></td>
<td></td>
<td>- Appropriateness of temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Appropriateness of lighting facilities</td>
</tr>
<tr>
<td>Technology policy and procedure</td>
<td>The extent to which the establishment has formulated policies and procedures to promote, regulate and control the use of technology</td>
<td>- Availability of comprehensive policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Appropriateness of furniture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Effective communication of policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Constant review of policy and its effects</td>
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</tbody>
</table>
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It is difficult to have an effective IT implemented without the leaders talking the talks and walking their talks. I speak of new innovations all the time and encourage teachers to find new ways of utilizing IT in their activities. To be an advocate is to sell the idea of IT to staff, teachers, community and I think we need this to stay ahead of the game.

In addition, effective IT schools use technology committees effectively. In one of the schools investigated, a committee of ten teachers, administrators, staff, students, and parent representatives provide an advisory role to the school leaders on matters relating to IT. The advantages of a technology committee are many. Each member of the committee provides an additional advocacy role and information regarding resources such as grants that may further help IT management in the school.

Apart from the use of technology committees, effective schools have personnel with the sole responsibility of overseeing IT management. Such personnel are generally senior administrators for their school districts. It is advisable that the chief information officer for a school district reports directly to the school superintendent and to the school board. The CIO, along with the technology committee and the superintendent, provides the necessary leadership for IT management in effective schools. While the school superintendent provides the executive leadership, the CIO provides the technical leadership, and the technology committee provides the political leadership to IT management within the school district.

**IT planning**

In many schools, IT activities are disjointed and uncoordinated. Activities occur as individuals are motivated to initiate them and to the extent that grant resources become available to carry out these activities.

Consequently, an effective planning approach is often lacking and where planning is done at all, little attention is paid to insights from the literature. Picciano (1998, p. 19) acknowledged that “the major impediment to establishing successful computer-based applications in schools now is the lack of careful planning”. Similarly, Maddux et al. (1992) reported that the process of integrating technology in school has been poorly planned and chaotic. Commenting about higher education institutions which are not unlike school organizations in this regard, Cartwright (1996, p. 57) noted that:

> Of course, most institutions pride themselves on planning for the future. After all, we try to forecast what students will need to know five to 25 years in the future. We began planning for technology when computers became important to administrative aspects of running a college or university. In most cases, though, that early technology planning was idiosyncratic, had a short time horizon, and was carried out in relatively unilateral terms by discrete units. (p. 57)

The author went further to identify types of planning that characterize IT management in many educational institutions. For example, the “end-of-the-year scramble” is hardly a proactive approach but many schools find themselves in a frenzy to spend the budget leftover on hardware acquisition toward the end of the school year. Also, according to Cartwright (1996), a “neo-passe chaos” or “the modern-day ostrichian approach” is also not a proactive planning strategy since IT initiatives are left in the hands of whoever is interested. The author observed that “when departmental technology resources and directions are entirely dependent upon the whims of their unfettered, idiosyncratic technology gurus, it is not uncommon that departments soon find their technology out of date and

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*Figure 1*

Ratio of students to microcomputers in American K-12 schools

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983*</td>
<td>12.5:1</td>
</tr>
<tr>
<td>1984**</td>
<td>6.3:1</td>
</tr>
<tr>
<td>1986*</td>
<td>5.0:1</td>
</tr>
<tr>
<td>1990*</td>
<td>2.0:1</td>
</tr>
<tr>
<td>1993**</td>
<td>1.1:1</td>
</tr>
<tr>
<td>2000*(projected)</td>
<td>0.6:1</td>
</tr>
</tbody>
</table>

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*Source: Picciano (1994)*

**Source: Educational Statistics Abstract**

Note: 1. While progressive, proactive school leaders would continue to monitor the ratios of computers to pupils in their schools and compare these statistics with the national trend, the most useful information is the extent to which the supply of technology in a school meets the demand for the technology.

2. Demand for technology in a particular school should be monitored and defined in relation to the current state-of-the-art use of technology in schools. Therefore, access rate must be defined both quantitatively and qualitatively.
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adrift from the mainstream” (Cartwright, 1996, p. 58). A “father knows best” is a planning approach left completely in the hands of the head computer administrator or the CIOs (Cartwright, 1996). While this approach has some advantages (for example, the technical people are competent in deciding the compatibility of new hardware acquisitions), innovations poorly understood would only become lukewarmly adopted by the school community. Cartwright (1996, p. 58) also noted another planning approach, the “Polynanna/Phillipanna utopia”, in which “all other institutional activities are put on hold for several weeks each year while individual departments, colleges, divisions, and other units engage in collaborative consensus development”. As mentioned by this author, “this joyful combination of bottom-up and top-down strategies accompanied with twice weekly breakfast and lunch meetings yields consistent results: a long-term plan with annual budgets; another planning office; and an average 7-pound weight gain for each of the participants” (Cartwright, 1996, p. 58).

However, effective schools are striving to learn the lessons and benefits of good IT planning. IT planning as an element of best practices in schools is defined as the extent to which technical activities and initiatives are driven by a proactive, systematic plan. Rather than depending on happenstance, effective schools are proactive in initiating IT plans that will be relevant to the future needs of students, teachers, and the entire school community.

Picciano (1998) identified four criteria of best practices in IT planning, which are characteristics of IT best practices in schools. First, effective IT planning is comprehensive, covering all the essential elements of information technology. A comprehensive IT plan identifies IT goals, links goals to resources and budgets, examines possible implementation problems, and develops strategies to enhance IT management in the school. Indeed, a comprehensive plan would entail consideration of all the best practices discussed in this article.

The second characteristic of IT in effective schools is collaboration. IT planning in effective schools is bottom-up with planning information flowing from those who are charged with the implementation of the plan; it is top-down with the blessing of those who have the power of resource allocation; it is strategic in that it is aligned with the future vision of the school organization; and it enjoys the support of important stakeholders. The IT planning process becomes an important political tool as planners collaborate with different segments of the community. One of the schools studied had a local librarian and the owner of a local computer business serving in the planning committee.

Another characteristic of effective IT planning is continuity. IT planning is an ongoing process in schools with best practices. In this way, schools are able to keep in touch with the constantly changing world of technology and continue to translate these changes into valuable experience for their schools. This is contrary to the end-of-the-year scramble or the short-time, one-shot planning approaches that are found in many less effective schools. Monitoring activities start at the point of implementation and provide data for the next stage of planning with a never-ending information gathering-deliberations-implementation-monitoring loop.

The last characteristics as suggested by Picciano (1994) is commitment. Schools are notorious for plans that enjoy limited support and have little or no commitment from important stakeholders. Commitment is earned in IT effective schools through participation and information sharing. Participation breeds enthusiasm and enthusiasm, on the other hand, provides the energy needed for effective implementation of IT plans. These four characteristics form the cornerstone of IT planning in schools where best practices are embraced.

Staff development

Schools in America require staff development for their teachers and staff. However, most of the staff development currently available concentrates on curriculum and pedagogical matters. Since Becker (1991) noted that only a small fraction of teachers are major computer users, schools embracing best practices in IT management have made it mandatory for their teachers to have some computer experience and have made opportunities available for these teachers to update their computer skills and knowledge.

IT best practices define staff development as the extent to which staff development stays ahead of technological innovations utilization. One of the interviewees commented about her school: “The idea is to stay ahead if you can. While ‘CU-See Me’ (See You See Me) innovation is yet to be widely adopted, we have already had two seminars with an attempt to explore its potentials for our schools.”

Staff development in the schools with effective IT management have three measurable characteristics. First, staff development is personalized. Teachers are encouraged to submit personal staff development plan with a focus on computer training that the teacher
had had and the current training needed. In one school, each staff development plan is reviewed by the technology committee, with the intention of providing additional training recommendations where necessary.

Second, schools with effective IT management associate incentives with staff development. Staff development succeeds to the extent that there are resources allocated to fulfill teachers’ plans. Morale would dampen and energy would easily dissipate where time and effort are put into developing a staff development that goes largely unfunded. Some schools find creative ways to motivate their teachers. In one local school, a laptop computer was provided to each teacher’s class after attending training sessions.

Lastly, schools with effective IT management make opportunities available for staff development on a continuous basis. Staff development is not a one-time event as commonly found in less effective schools. Effective teachers receive continuous training; hence, staff development becomes a continuous activity. Also, although teachers are encouraged to submit plans for their own staff development, these plans are flexible enough to accommodate unexpected training should it become necessary. Unanticipated opportunities such as computer fairs in the local region where educational software packages would be displayed and demonstrated become attractive staff development opportunities for teachers. In one school, some teachers were given a half-day off to attend such unanticipated fairs. Staff development programs are an essential component of best practices in IT management and opportunities for retraining are an important indication of administrative support.

### Technical support

Technical support is inevitable in any credible IT management, especially in school organizations where there are hundreds of computer terminals and several hundreds of users, most of whom are children with an incredible penchant to trade software packages from usually unknown sources. Schools, as should be expected, experience a large number of troubleshooting problems daily, ranging from a neophyte struggling to operate a computer that is not switched on to an experienced user attempting to salvage a file ravaged by a mysterious virus. While many of the troubleshooting problems at schools could be prevented with proper training, it would be myopic not to have adequate resources in place on a continuous basis to respond to these problems.

For effective IT schools, technical support is defined as the extent to which help is available to users. The word “help” should be defined in its broadest sense to include the three measurable criteria identified in the model (See Table I). Perhaps the most important criterion to evaluate technical support is the amount of time it takes for users to get their problems solved. Technical support is critical in schools because computer-based instructions depend very much on the smooth running of equipment for the objectives to be achieved. Classes where there is an exact number of computers to children have a major problem if one child has a technical problem with his or her machine during instruction. Where this occurs, the classroom teacher is forced to attend to the child, keeping on hold the rest of the children. Classroom objectives will be thwarted if a technical problem takes more than five minutes of the classroom teacher’s time. Alternatively, the teacher may send for help, keeping the child on hold for help to arrive while proceeding with the classroom instruction. A child would be frustrated should the help take more than 10 minutes to arrive. Consequently, the waiting time for technical help is a critical concern in effective IT schools.

The second component of the technical support addresses the issue of quality of service. Effective technical help is that which actually rectifies the problems being experienced by a user. Best practices, therefore, call for a prompt diagnosis of a user’s problem and a quick decision as to how best to solve the problem. Even when a breakdown is very much the fault of a student, a positive attitude is necessary on the part of the technical support personnel. Rather than apportioning blame, best practices require that the process of solving the problem be converted into an educational experience for the children.

A new “expert group” is emerging in our educational landscape. To the extent that instructions are computer-based, this group, the computer technical crew, stands between teaching and learning, between the teacher and the pupils, between instructional goals and goal attainment. Unfortunately, few of the present cohort of technicians have been trained to understand school culture and to have educational goals as their primary concern. Few have the mentality of assisting the teacher’s work and facilitating the teacher’s efforts. For example, in one institution, a professor who was frantically “begging” or “bugging” the technical members for help stumbled on this e-mail message from one technician to another:

[Dear [Technician A], This is aggravating. Professor X has been to me, then to [Technician B], then to [Technician C] (names...
of course, this infuriating e-mail essentially severed further communication between the technical people and the professor. Yet, the organization is paying for technical support, but such support would be underutilized were the technical crew lack professionalism, and an understanding of their role in the educational sector, and essential interpersonal relations.

An information technology plan is a comprehensive plan that encompasses other plans. One of these plans is the maintenance plan which focuses primarily on anticipated and non-anticipated troubleshooting problems. Ensuring that loose cables are tightened up, keyboards are periodically cleaned, unwanted materials in the hard drives are deleted, and changing printers’ cartridges and ink bottles on a regular basis are part of important maintenance efforts – efforts that must be planned in advance. Since school activities are programmed according to the school calendar, maintenance plans must reflect school programming.

Schools investigated have different technical support arrangements. In one of the schools, teachers and students are trained to respond to minor troubleshooting problems. Perhaps this is the most effective way because students are able to help one another to solve their own problems. Another school has a vocational department where students are specifically trained to handle most troubleshooting problems. This group of vocational students respond to technical support requests as a means of furthering their own training. These schools have the shortest waiting time and, above all, benefit from students’ free labor. Other schools where faulty computers have to be shipped to the central office have a considerably longer waiting time and teachers and students report much frustration with this system.

It is important that every troubleshooting problem be recorded to keep track of their nature and frequency of occurrence. Effective IT schools would request that users rate the quality of the help and specify how long it takes for them to get their problems solved. With this arrangement, school leaders are able to keep track of progress with their technical support system.

**Hardware and software decisions**

Decisions regarding hardware and software are critical in IT management. This is so because hardware and software budgets may run into several hundreds of thousands of dollars for one school district. A systematic approach for resolving some of these decisions is noticeable in schools with effective IT practices.

Hardware and software components of best practices is defined as the extent to which the most appropriate technological system is in use. Five characteristics are obvious in effective IT schools. First, these schools have an efficient procurement plan. A procurement plan entails proactive thought about sales services, delivery services, and after-sale services. While different vendors are often solicited, the decision as to the best vendor is only arrived at after a serious analysis of each vendor’s total package. Less effective schools seldom plan ahead regarding procurement and only scramble for vendors when faced with an urgent need to acquire hardware.

Some schools are currently experimenting with leasing computers directly from the manufacturers. Most of these manufacturers provide direct technical support and will replace obsolete equipment at the end of each contract. While this has an advantage in that school leaders would not have to be concerned with how to discard their computers, leasing can be more expensive than direct acquisition. Therefore, it is advisable that a careful calculation be done to compare these options.

Second, effective schools achieve high compatibility between their hardware and software procurements. There are schools where hundreds of dollars have been spent on software packages that the current hardware cannot support and there are other schools where new hardware acquired is incompatible with the existing hardware. The problem of compatibility is a serious one for schools that often have no integrated approach to procuring their hardware and software. This problem becomes acute when procurement is driven by grants from different sources by different grant writers. Unless there is a central clearing-house through which the kind of computer hardware and software specified in each grant application is harmonized with the existing system, as was the case in one of the
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Effective schools, incompatible systems will continue to be frustrating for school leaders. The purpose of computers in school is to enhance teaching and learning. Therefore, the effectiveness of the IT system in achieving instructional goals is of paramount importance. For IT to be instructionally effective, it must achieve the following criteria: it must be easy for teachers to understand and use, attractive to students, adaptable to varied instructional objectives, and the advantages of using the system should clearly outweigh the time and efforts needed to operate it.

Effective schools employ IT to achieve their administrative functions. These functions range from database management for students to using electronic mail for staff communication and to using schedulers to manage common rooms’ activities.

Few school leaders think about the problem of equipment obsolescence. Computers are not built to last for ever. In fact, microcomputers have an average life span of five to seven years. It is important to differentiate between computer life span as it relates to efficiency and as it relates to functionality. Microcomputers may remain functional for many years, perhaps 15 years or more, but the life span efficiency is much shorter. While the early microcomputers developed may still operate functionally today, they would be grossly inefficient as compared with the modern Pentium microcomputers. Consequently, effective IT schools would have a replacement plan as a part of their overall IT plan. In one school, an attempt was made to number each computer with a serial number, acquisition date, and suggested replacement date. For example, a computer with the following number: 112-92-98, has a serial number of 112, was acquired in 1992, and it is advisable to replace the equipment by 1998 all things being equal.

Closely akin to the replacement plan is the issue of what to do with the obsolete computers. Most schools have no proactive way to deal with obsolete computers. Schools have storage rooms littered with discarded computer junks. Unfortunately, the computer industry is yet to come up with a widely acceptable way of dealing with obsolete computer equipment. Until manufacturers develop a recycling strategy, school leaders will have to deal with the issue of discarding retired computers.

**Technology budgets**

Oberlin (1996) provided an in-depth discussion of financial issues relating to technology. Those who are new to technology often have a wrong notion regarding financing technology. Many think technology is a one-time investment and many more think technology will provide immediate, dramatic cost reduction for their organizations. Experience with IT has proven to the contrary. Indeed, costs continue to increase in schools as they strive to embrace technology even at a time that the full advantages from technology investment are difficult to quantify. However, some have argued that the true cost of technology is not investing in it.

For the purpose of best practices in IT management, the technology budget would be defined as the extent to which financial resources are made available to meet technological goals. Three important considerations emerged from the IT audits conducted in schools located in north-east Ohio. Each school has its own technology budget philosophy, although this philosophy may not be clearly stated. Three budget philosophies were apparent in the schools investigated. Where there is no consciously developed technology plan, the technology budget philosophy, albeit unstated, is simply “wait and see.” Fortunately, the number of schools with a wait and see attitude is fast diminishing.

The second technology budget philosophy can be described as a “cut-your-coat-according-to-your-fabric.” With this approach, the amount of financial resources available, after all the necessary contingencies have been budgeted for, determines IT progress. Just as one who cuts his/her coat according to the available fabric may end up with an over- or under-sized coat, this approach, although the most conservative of all, is seldom a strategic, proactive, and smart option in an increasingly competitive environment.

The third approach may be described as the “blue sky” budgeting practice. Operating under this philosophy, IT planners develop their technology goals for the year unperturbed by considerations of financial constraints. Activities are planned to reflect IT goals, and then resources are sought to accomplish the plan. A “blue sky” IT budgeting philosophy is an aggressive approach and very suitable for a competitive environment. However, unrealistic or overambitious planning practice may have a devastating effect on the school organization. To prevent this from happening, planners operating under the blue sky philosophy may develop their plan in several phases. Each phase will be achieved as financial resources become available.

The second best practice consideration regarding IT budgeting has to do with the ratio of IT budget that is funded through soft money. Indeed, most IT activities in schools to date have been funded by soft money. Some school districts have full-time personnel in...
Infrastructural facilities

Successful implementation of IT management requires more than an assemblage of computer hardware and software. There are non-computer related materials or facilities that must be acquired and established for IT to be effective in schools. For this purpose, infrastructural facilities, as a function of best practices, are defined as the extent to which non-technology-related facilities are available to support effective IT utilization.

Most microcomputers can comfortably be housed in room temperature so one or two computers in an average size room may not warrant an adjustment in the room temperature. However, computers emit heat and it quickly becomes uncomfortable for users in an overcrowded room. From personal experience, teaching in a computer laboratory during the hot summer months without appropriate room temperature can be very frustrating for both students and teachers. As the number of computers to be housed in a room increases, attention must be paid to the room ventilation and temperature.

Students are spending an increasing number of hours on computers; thus, matters relating to ergonomics are becoming crucial for school leaders. The kind of furniture in use has serious implications for IT effectiveness and, also, serious effects for the health of the users. There are schools where regular desks and chairs are still being used, but an increasing number of schools are investing more and more in furniture specially designed for computers.

Most schools have a local area network (LAN) which calls for a great deal of wiring. Where connections are sloppy with cables littering the floor, poor communication among computers may result, accidents involving injuries may occur and, above all, the aesthetic aspect is highly reduced. Consequently, attention to the room conditions is a wise IT management practice. Room lighting is also a crucial dimension of the room conditions.

Many computer rooms are equipped with the normal classroom lighting facilities. However, this lighting arrangement becomes inappropriate where multimedia presentations are expected to be done. Lights are generally switched off to achieve a sharp contrast on the screen when presentation software is used. But, under this condition, students find it extremely difficult to take down notes during presentations. Schools with effective IT practices have desk lights that can be dimmed by individual users. This allows each user to adjust the desk light as needed by the user without disrupting the class presentation.

IT policy

IT has become a very powerful tool since the integration of communication devices, computers, and videos. The attraction is unlimited for children (and adults too) and where there are hundreds of children with an insatiable appetite for interactive technology, schools must come up with rules and procedures to safeguard the school as well as the users themselves. Although IT provides tremendous learning opportunities for children, the dangers presented by unrestricted access to all the potentials could prove detrimental.

IT policy is defined as rules and regulations that maximize conditions under which IT is utilized while minimizing the associated risks. IT policy reflecting best practices have several characteristics. IT policy in effective schools is comprehensive, covering rules regarding the use of computers, dos and don’ts in computer labs, and the consequences of noncompliance.

Second, IT policy in effective schools is flexible and subject to constant revision. IT developments are rapid and unpredictable. Even less predictable are the users’ attitudes that should make safety of school children surfing...
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the Net a major concern to administrators. Therefore, IT policy must be revised constantly to reflect new developments. Third, IT policy in effective schools is essentially educational. IT policy should not be a mere collection of prohibitive rules but should be a means of providing proactive strategies to cultivate positive attitudes in users. IT policy is used for educational purposes to enhance students’ knowledge of rules governing human social interactions on and off the Net. Fourth, IT policy in effective schools is child-centered. Policies are developed for the sole purpose of protecting students and enhancing their knowledge. Lastly, IT policy in these schools is a product of joint efforts. Students, parents, and school leaders all participate in developing their policies. In this way, everyone owns the policy, and everyone understands the problem that each policy statement is attempting to prevent.

Conclusion and recommendations
There is definitely a leadership dimension to information technology management in K-12 schools. But the leadership dimension in this sector has been less emphasized or discussed in the literature. Yet, technology in schools would remain poorly adopted unless a strong leadership is provided to IT initiatives. With over a decade of schools’ experimentation with microcomputers, the field is ripe for researchers’ and educators’ search for best practices. School leaders interested in best practices are, however, limited by the scanty literature on IT in schools. Writers have been concerned primarily with the prescriptive and descriptive impacts of technology on education in general and the relevance of technology to specific curriculum delivery. Indeed, school leaders have limited resources at their disposal; hence, the need for an article that presents insights of how school leaders may organize their IT or evaluate their existing system.

The model presented in this article is a culmination of technology audits of many school organizations. The strength of this model lies in its comprehensiveness in covering IT issues and its practical usefulness to school leaders who are interested in taking their IT management to another level of excellence.

School leaders interested in excellence in IT management should pay attention to the access rate of their users. Access to IT must be defined broadly to include a diverse body of users. Leadership promise is essential for effective IT management. School leaders can no longer afford to remain aloof and delegate all IT initiatives to their technical personnel.

Comprehensive and systematic planning should drive IT initiatives in schools. The current practice, whereby IT activities are driven by grant seekers, cannot be deemed appropriate. Staff development should be continuous and individualized. Investment in teachers’ and staff’s computer knowledge and skills is a wise investment for schools. Technical support must respond promptly to users’ needs in K-12 schools. Users’ attention span is short at this level and even shorter during class lessons; therefore, schools need to search for a creative way to respond immediately to users’ requests.

A acquisition of hardware and software entails more than a last minute rush to the computer stores. A procurement strategy must be planned, purchases of hardware and software must be done with full attention to system compatibility, the IT system must fully support and enhance instructional activities and goals, and a replacement procedure must be carefully thought out.

Schools should adopt an appropriate budget philosophy. While soft money should be sought and obtained, efforts should be made to ensure that a particular percentage of the operating budget is reserved for IT. Effective schools have an expanded view of IT—a view that includes attention to room conditions and ergonomics. Indeed, school leaders have a critical role to play if they are to ensure that their schools achieve a higher level of excellence in information technology.

In closing, school leaders who intend to be proactive with their IT management practice should find the following recommendations useful:

- In an increasingly competitive environment, attention to the trend within the industry is a prudent management practice. School leaders must understand that their schools are in competition with other schools for grants and in their striving for excellence. Therefore, attention to the trend within the K-12 school sector is a wise leadership strategy.
- School leaders must expand their role in influencing and shaping how IT impacts their schools. IT can no longer be left in the hands of the technical personnel. Realistic and strategic IT progress entails full participation and commitment of both the school leaders, the technical personnel, and the school community.
- Striving for excellence in IT requires attention to best practices. While each school organization may have its own unique situation, best practices, as defined here, are generic, qualitative prescriptions that
school leaders should strive to achieve. A systematic monitoring of school’s progress with respect to each of the elements discussed in this article should be undertaken.

- The ideal goal for school leaders is to become the industry leader, experimenting with cutting-edge technology and, therefore, setting the pace for others. School leaders should conduct their own audit and compare their findings with the best practices discussed in this article. But leaders should strive for their own creative and innovative practices that may bring our understanding of best practices to another level.

- Scholars and researchers in the field of educational management should focus more attention on school practices regarding IT. Writers should document exemplary IT management practices in simple, non-technical language and in a way that will be beneficial to school leaders who have no formal education in computer science. The leadership dimension of information technology is an important component of IT management that should occupy the interest of researchers in the field of educational technology.

References


