CHAPTER ONE

Why Should Classroom Teachers Be Technologically Skillful?

U.S. schools spend billions of dollars on educational technology each year. While education budgets shrink, classroom sizes grow, accountability measures skyrocket, and teacher salaries remain stagnant, one has to wonder if this huge investment in wires, motherboards, and things that go beep in the night is actually improving schools' effectiveness.

I don't know that anyone has the definitive answer. It depends on whom you ask, what is being measured, and how educational "effectiveness" is defined. There is a good deal of research out there, little of it conclusive and much of it sponsored by those who have a financial interest in its outcome. Critical writings abound, including the Alliance for Childhood's *Fool's Gold* report (2000); Jane Healey's book *Failure to Connect* (1999); and Larry Cuban's book *Oversold and Underused: Computers in the Classroom* (2003). Admittedly, these references are a bit dated, but they raise valid arguments in terms of the monetary investment in educational technology versus the lack of evidence-based research on the outcomes.

What's a classroom teacher to think? Are personal investment in technology and the hours it takes to learn about it worthwhile? One may not have a choice.

In her book *In the Age of the Smart Machine* from way back in 1989, professor Shoshana Zuboff presciently described two distinct types of impact technology has on the workplace: *automating* and *informating*. The first thing businesses do is automate with information technologies, taking standard operations and making them faster, more accurate, and less labor intensive. But the real power of technology, Zuboff argues, is evident when it starts allowing organizations and individuals to do things that would not be possible without it.

Confused? Let's look at some examples from education:

- Electronic grade books *automate* the functions of the good old red booklets, allowing grades to be calculated, class lists imported, and grades exported to the student information system. But when the grade book is made Web-accessible to parents, they can monitor their children's progress in real time and intervene long before the conference at the end of the first grading period. Some systems even e-mail parents when their child receives a failing grade on a test. That's *informating*.
- Moving worksheets and tutorials onto the computer screen *automates* drill and practice teaching, enhancing it with immediate feedback and engaging sounds and visuals. In *informated* programs the tests and tutorials serve as a means of formative testing, giving the teacher the knowledge of precisely which skills individual students need to learn (ideally before the next big state test).
- The traditional "stand and deliver" lecture that is common in so many classrooms can be *automated* by enhancing it with a well-designed presentation that might include clarifying photographs, diagrams, and highlighted key concepts. Multimedia production tools *informate* the educational process when students themselves use them to communicate the results of constructivist-based learning activities that require higher-level thinking skills and original solutions to problems.
- Computers in labs, libraries, and classrooms *automate* the standard educational practices of writing, computation, and research. Small communication devices wirelessly connected to networks, such as laptops and handheld computers, *informate* the learning environment, allowing their student users anytime, anyplace access to resources, learning opportunities, experts, and each other. These devices have the potential of providing individualized instructional programs to every child, not just those identified as having special needs. Aren't we all, to some extent, learners with "special needs"?

Just as technology has reshaped the business sector over the last two decades, it is reshaping the educational landscape in powerful ways and will continue to do so at an accelerated pace.

Revolution or Evolution in Educational Change?

Easy to do is easy to say.

Attitude plays a major part in any change effort. (I know, "Well, duh!") Geoffrey Moore, in his book *Inside the Tornado* (2004), neatly divides people implementing new technologies into visionaries and pragmatists, and suggests we need to work with each group differently (p. 18):

Visionaries	Pragmatists
Intuitive	Analytic
Support revolution	Support evolution
Contrarian	Conformist
Break away from the pack	Stay with the herd
Follow their own dictates	Consult with colleagues
Take risks	Manage risks
Motivated by future opportunities	Motivated by present problems
Seek what is possible	Pursue what is probable

After years of living in denial, I must come clean. I am a *pragmatist*. Perhaps I was once a visionary, but having worked with real people, contended with real technologies, and been employed by real schools for the past thirty years, I am now a full-fledged pragmatist.

Survival tip: As a former classroom teacher and librarian and as a current technology director, I understand the apprehension about technology felt by many competent, effective, and thoughtful teachers. For those who are reluctant, I offer this advice:

1. Invest time in learning computing basics.
2. Use what technologies personally empower you with your students. If a word processor makes you a better writer, use that technology with your students. If a graphing program helps you better visualize math concepts, share it with your classes. If you enjoy networking with your peers online, communicate with your students and their families who also enjoy using such methods.
3. Become a colearner with your students in regard to technology. Kids will always be more knowledgeable and comfortable with the gizmos than us "mature" folks. Let them teach you or join them in learning something new.
4. Be skeptical, but remain open-minded. Unless the new technology has sufficient potential for learning opportunities for your students, don't jump in. These bright toys can be fun and seductive. Just make sure they have a purpose.
5. Expect reliable, secure, and adequate resources from your school. You shouldn't need to create two sets of lessons plans: one for when the technology works and one for when it doesn't.

And instead of being ashamed, I am proud. Sure, it's exciting to hear those pointy-heads pontificate about how things "really ought to be," but putting vision into practice is where we pragmatists shine—where the vision is practical, of course. And when it actually makes sense for our students and for us.

Of course the chance of success must be high. The change must be demonstrated in other schools to have actually improved kids' or teachers' lives. I would argue that making something work in the real world on a broad scale takes as much genius as, or greater genius than, thinking it up in the first place.

A visionary pundit might describe how using "tags" within a social bookmarking site can facilitate the collaborative problem-solving process. Visionary! Very cool! But when I demonstrated social bookmarking to a group of teachers, one excitedly raised her hand and asked, "Do you mean students could store their research paper bookmarks there so they could keep them even after the tech director reimages the lab? Or could get to them from any computer?" Pragmatic! Very cool! Bless her big, practical heart.

Let's hold our heads high, fellow pragmatists. We're doing good things. It just takes us a little longer.

Developing a Framework for Thinking About Technology in Schools

Ever had these thoughts?

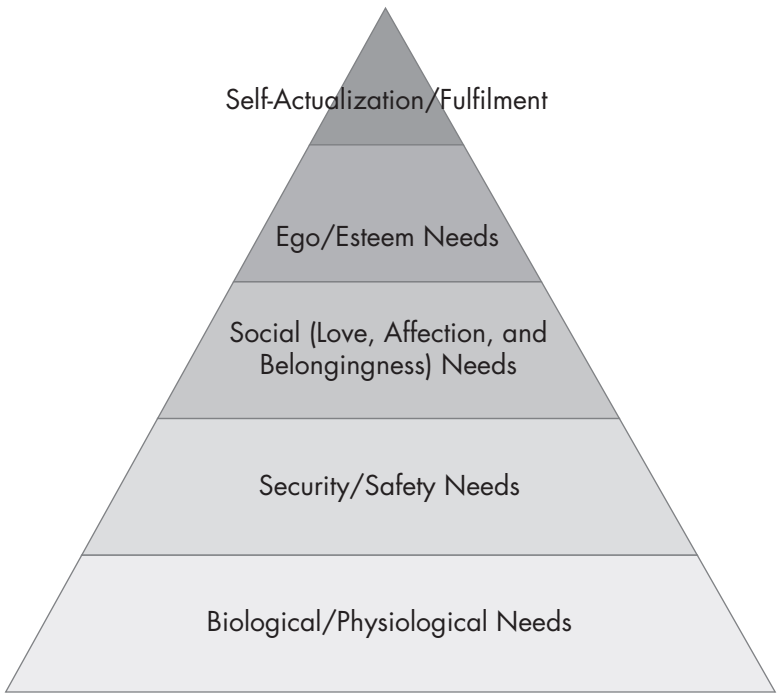
- If the technology worked all the time and like it was supposed to, I'd use it.
- Those technicians! They have the computers so locked up, the kids can't do anything.
- Seems like we are always short of powerful computers for students, but the folks at the district office always have new machines.
- Another grade book program to learn! Why can't the district just pick one and stay with it?
- We're putting students' records online? How do I know they will be secure?
- I'd like to do more project-based units, but it seems the resources just aren't there.
- What do kids really need to know about and be able to do with computers?

Such statements often stem from a lack of a holistic view of technology use in schools—on the part of both teachers and administrators. The magazines teachers read stress the classroom uses of technology. The conferences educators attend often

are filled with vendors who are trying to sell packages for managing instruction, software solutions, or devices that are only small pieces of the educational technology use puzzle. Staff development efforts focus on learning how to use management software without helping teachers understand how their efforts fit into their school's overall goals. Why does this occur?

Too few educators have a "big picture" understanding of educational technology use—of technology planning and implementation in terms of hierarchical needs. All who are affected by the educational uses of technology need to understand the overall dimensions of its use if they are to accept it. What follows is a planning model that is comprehensive and simple enough for all educational stakeholders to understand.

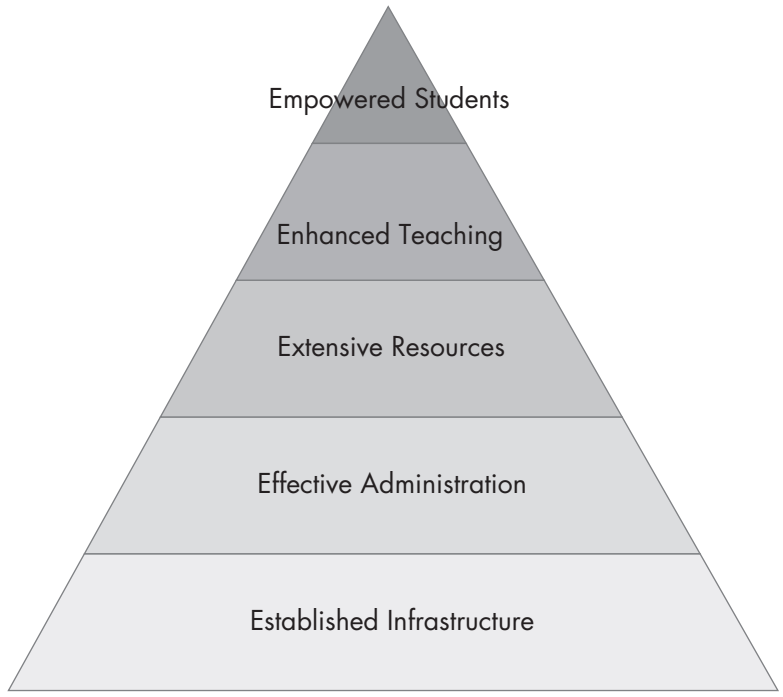
Remember Maslow from your college education foundations classes back in the last century?



An Interpretation of Maslow's Hierarchy of Needs

In simple terms, Maslow's theory states that before one can have the important things in life, such as love, self-esteem, or fulfillment, some basic needs, such as food and safety, must be satisfied.

We can extend Maslow's theory to the implementation of technology in schools as well. I have called this new theory Johnson's Hierarchy of Educational Technology Needs. Much as Maslow theorizes that physiological needs come before psychological needs, a school district must meet its infrastructure needs before it can reach its goal of using technology to empower learners.



Johnson's Hierarchy of Educational Technology Needs

The following paragraphs describe each of the "needs" in the diagram; how it influences student performance; and how, if not met, it keeps you, the classroom teacher, from being able to help students learn.

ESTABLISHED INFRASTRUCTURE

The district must have a reliable, adequate, cost-effective, and secure technology infrastructure that supports the learning, teaching, and administrative goals of the district.

One of the most critical and potentially limiting factors in the successful implementation of information technologies in schools is reliability. Nothing keeps an administrator from using a data-mining tool, a librarian from using an online database, a teacher from using a Web-based lesson plan, or a student from creating a multimedia presentation like the uncertainty that the technology might fail at a critical moment. We rely on electricity, natural gas, television, and telephone services because these technologies have reached "five nines" reliability. We can count on them to work 99.999 percent of the time. Although techno-advocates often ask users to have a backup plan in case of technology failure, users have been reluctant to take this precaution. Why? It effectively doubles one's workload.

Adequacy is a second important criterion that must be acquired before users in schools will trust technology for the completion of critical tasks. Administrators will not use online accounting systems if there is a long delay in accessing the

program because the available bandwidth is not adequate. Teachers and librarians will not plan units that call for the use of electronic sources of information if there are too few computers for students to use or if they know the computers will be out of commission for testing for several weeks out of the year. Students who cannot rely on working technologies because technicians are overloaded with work will find other means to complete assignments.

Finally, concerns about security keep many users from trusting and using technologies in school. Good data backup practices, enforceable (and enforced) data privacy policies, and hardware and software that prevent unauthorized internal and external access to data on school networks are critical needs for all organizations. A lack of IT professional expertise in many school districts has caused this need to not be met. Educators and parents are skeptical of the extensive use of digital record keeping if they cannot be assured that confidential information about their children will remain confidential.

As a teacher, use this checklist to determine how your district is meeting the need for an established, reliable infrastructure:

- ❑ **1.** Adequate and reliable Internet access throughout the district
- ❑ **2.** Adequate and reliable Internet access in all buildings
- ❑ **3.** Adequate and reliable Internet access in all classrooms, media centers, and labs
- ❑ **4.** Adequate and reliable wireless network access
- ❑ **5.** Written IT security and disaster recovery plan
- ❑ **6.** Firewall security for networks
- ❑ **7.** User verification through log-in requirements and activity logging
- ❑ **8.** Districtwide virus protection software
- ❑ **9.** Districtwide spam (junk e-mail) filtering software

- ❑ **10.** Districtwide Internet filtering software
- ❑ **11.** Remote computer desktop monitoring and maintenance
- ❑ **12.** Backup plan for all data
- ❑ **13.** Adequate workstations for staff and student use
- ❑ **14.** Adequate peripheral technologies (printers, scanners, projectors, cameras) for staff and student use
- ❑ **15.** Adequate and efficient maintenance, repair, and replacement procedures, and availability of an online help desk
- ❑ **16.** Adequate and reliable telephone access to all classrooms and offices
- ❑ **17.** Adequate and reliable interactive video access in schools offering distance education classes
- ❑ **18.** Written and thorough technology use policies
- ❑ **19.** Adequate leadership and management related to technology planning, budgeting, and policymaking

EFFECTIVE ADMINISTRATION

The district must use technology to improve its administrative effectiveness through efficient business practices, communication, planning, and record keeping.

Schools are also businesses. They must have good accounting, budgeting, and purchasing practices if they are to have credibility with the taxpaying public. They must maintain records of test scores, grades, and attendance of students for state, local, and parental reporting. They must keep personnel records and meet payroll. They must track and control transportation, food service, and special education spending. And all of these needs must be met before teachers can teach and students can learn.

Increased demands for accountability by the public in regard to both expenditures and student achievement have also increased the need for more accurate and sophisticated uses of administrative technology in schools. Efforts to tie measurable student achievement to specific educational practices and their funding will mean that educational decision makers need to gather, organize, store, extract, and analyze

data in powerful ways. Effective, efficient data-mining practices are possible only with information technology and educators trained in its use.

Efforts to give educational consumers (parents) the ability to compare schools have resulted in K–12 schools' competing for students. This competition has led to a new emphasis on using technology as a communication tool. Such communication technologies as e-mail, electronic mailing lists, Web sites, and social networks are playing an increasingly important role in how schools both inform parents and the public and receive feedback from them. Schools need to see information technologies as marketing tools and use them as such. Parental access to real-time data about their children's daily performance through Web-accessible grade books and attendance records, teacher Web pages, and curriculum outlines and outcomes, as well as student achievement data showing comparisons among local schools, is as critical for schools to provide as online banking services are now for financial institutions who wish to remain competitive.

It is not just student learning that will suffer as a result of inattention to the administrative uses of technology—the existence of individual schools themselves may hang in the balance.

As a teacher, use this checklist to determine how your district is meeting the school's administrative needs:

- ❑ **1.** Student information system that can be accessed by administration, and that includes attendance, grading, discipline, health, and scheduling modules and that shares data efficiently with other systems
- ❑ **2.** Student information system that can be accessed by teaching staff
- ❑ **3.** Student information system that can be accessed by parents
- ❑ **4.** Student information system that can be accessed by students
- ❑ **5.** System that allows data warehousing and data-driven decision making
- ❑ **6.** Systems specific to the management of finance, transportation, personnel and payroll, lunch programs, special education, building systems, and security
- ❑ **7.** System for curriculum management

- ❑ **8.** Portable communication devices for staff use, such as cell phones, laptop computers, tablets, or personal digital assistants (PDAs)
- ❑ **9.** Online (Web-based) district information
- ❑ **10.** Online (Web-based) building information
- ❑ **11.** Online (Web-based) department and classroom information
- ❑ **12.** Interactive communication tools for the administration (instant messaging, electronic mailing lists, collaborative project tools, shared calendars, and e-mail directories)
- ❑ **13.** Electronic means of communication with school staff by parents, students, and the community
- ❑ **14.** Established technology competencies and training opportunities for the school's administration and office staff
- ❑ **15.** Adopted policies and written guidelines on Internet use, safety, plagiarism, selection and reconsideration of digital resources, copyright, and so on
- ❑ **16.** Familiarity with policy and ethical practices concerning technology use by administration and office staff

Note that both of these lower levels (infrastructure and administrative use) of technology planning do not directly involve student use. But they both have an impact on learning because the needs at these levels must be met in order for the higher-level needs of students to be met. Schools that use technologies to increase administrative efficiency can spend more money on direct instruction, purchase better resources, lower class sizes, and have a better-trained staff. These basic uses of technology support any form of instructional practice, from traditional to constructivist.

EXTENSIVE RESOURCES

Technology must be used to provide the most current, accurate, and extensive information resources possible to all learners in the district and community in a cost-effective and reliable manner and at maximum convenience to the user.

Progressive thinkers in both education and business recognize that acquiring basic skills and memorizing a core of facts, although important, are only the foundation of an education in the twenty-first century. Working collaboratively, recognizing and solving genuine problems, evaluating and using information from both primary and secondary sources, communicating effectively, and assessing one's own performance are the new "basic skills" for workers in an information-based economy.

Many teachers are reluctant to implement a project-based, constructivist approach to learning because of the lack of resources their students can use. Ironically, budget makers often question why technology expenditures are necessary when *our* teachers just use textbooks as the primary information source for instruction. This is a genuine catch-22.

If teachers are to design curriculum materials, instructional units, student activities, and assessment tools that teach 21st-century skills, they will need more extensive information resources than in the past. Information in both print formats (made more accessible through electronic library catalogs and periodical databases) and digital formats, such as online subject area databases, full-text periodical databases, e-books, and reference tools, is necessary if students are to have the learning experiences that lead to the ability to access, process, and communicate information. Information processing and communication tools are also necessary: word processing programs, desktop publishing software, spreadsheets, databases, visual organization tools, Web creation software, graphic creation tools, and digital photograph and video editing tools.

Teachers need access to professional resources that will help them improve their own practice as well. Research databases, electronic journals, electronic mailing lists devoted to professional practice, Web-based professional learning communities, and online classes and tutorials are effective components of any staff development effort.

I would include in this category the need for school library media specialists and technology integration specialists who use their expertise to help both teachers and students use electronic resources meaningfully. Too often human resources are not seen as integral to the successful implementation of technology.

As a teacher, use this checklist to determine how your district is meeting your digital resource needs:

- ❑ **1.** Sufficient access to computing devices for students to complete assigned work

- ❑ **2.** Access to a professional library media specialist with skills in selecting, evaluating, and using electronic information sources
- ❑ **3.** Internet access with minimal filtering
- ❑ **4.** Access to the online building library catalog
- ❑ **5.** Access to the online district union library catalog
- ❑ **6.** Access to online catalogs of public, regional, and academic libraries
- ❑ **7.** Access to adequate online periodical databases
- ❑ **8.** Access to adequate online subject-specific databases
- ❑ **9.** Access to adequate online reference materials including encyclopedias and e-books
- ❑ **10.** Access to adequate digital image, sound, and video resources
- ❑ **11.** Access to curriculum and teacher support materials
- ❑ **12.** Access to a wide variety of computerized productivity programs appropriate to student abilities
- ❑ **13.** Access to a wide range of educational interactive applications including practices, simulations, and tutorials to support content-area learning objectives
- ❑ **14.** Access to needed content-specific hardware, such as scientific measurement devices, calculators, and other technology-based education tools
- ❑ **15.** Access to educational television programming through broadcast and cable television and Internet streaming
- ❑ **16.** Access to desktop videoconferencing hardware and software
- ❑ **17.** Software and network resources needed to electronically publish and share school-, teacher-, and student-produced information

ENHANCED TEACHING

All district teachers must have the technology training, skills, and resources needed to ensure that students will meet local and state learning objectives, and they must have the technological means to assess and record student progress.

The meaningful use of information technologies by teachers falls into two categories: *personally productive* and *transformational*. Remember Zuboff's automating and informating from the beginning of this chapter?

Teachers in the *personally productive* mode design more worksheets, guides, and objective tests that are easy to read—all of which are readily modified using a word processor. They more quickly report student grades and attendance using a networked administrative system. They communicate more effectively with students, other staff members, and parents if they can use e-mail and create Web pages. They can access a myriad of already existing learning activities through online repositories. No educational practices genuinely change with these kinds of uses, but traditional tasks can be done more efficiently, effectively, and accurately. When a teacher spends less time creating instructional materials, recording and reporting student progress, and communicating with parents, the time saved can be used for directly interacting with students or for designing more effective lessons or units.

The *transformational* use of technology changes the role of the teacher as well as what is taught and how it is taught. The technology is used to actually restructure the educational process to allow it to do things it has never been able to do before. Such technology use helps teachers do the following:

- Provide instruction that enables all students to master the basic skills of writing, reading, and computation by using a variety of teaching strategies and tools to meet diverse student learning styles
- Design and implement constructivist-based units that provide students with instruction and practice in authentic information literacy and research skills and the higher-order thinking skills inherent in those processes
- Design student performance assessments that lead to improved learning
- Use assistive and adaptive technologies with students with special needs
- Provide students and parents with
    - Individual education plans for every student
    - Continuous feedback on how well students are meeting their learning goals
    - Opportunities for virtual assessments of student performance
- Locate and use research findings that will guide their educational practices
- Collect and interpret data that measure the effectiveness of educational practices

Society is asking schools to accomplish two difficult goals: (1) guarantee that every student has basic skills, and (2) prepare an ever larger number of graduates for a knowledge-based economy that requires workers who are self-motivated, can solve genuine problems, can communicate well, have the interpersonal skills to work collaboratively, and can upgrade their skills by purposely continuing to learn. (See the "Gone Missing" sidebar.) Employing teachers who are well versed in technology use is the only way schools will be able to achieve these results.

As a teacher, use this checklist to determine how your district is meeting your staff development needs:

- ❑ **1.** Basic professional productivity skills for all teaching staff
- ❑ **2.** Basic Internet skills for all teaching staff
- ❑ **3.** Skills related to integrating the use of technology into classroom units for all teaching staff
- ❑ **4.** Familiarity with policy and ethical practices concerning technology use by teaching staff
- ❑ **5.** Knowledge of and practice in using adaptive devices with children with special needs
- ❑ **6.** Assessments to measure the status of teaching staff competencies in technology
- ❑ **7.** Formal training opportunities for developing technology skills
- ❑ **8.** Just-in-time training opportunities for developing technology skills
- ❑ **9.** Ongoing mentoring, troubleshooting, and assistance for staff members when they are developing technology skills
- ❑ **10.** Technology skill evaluations as a part of teacher evaluations

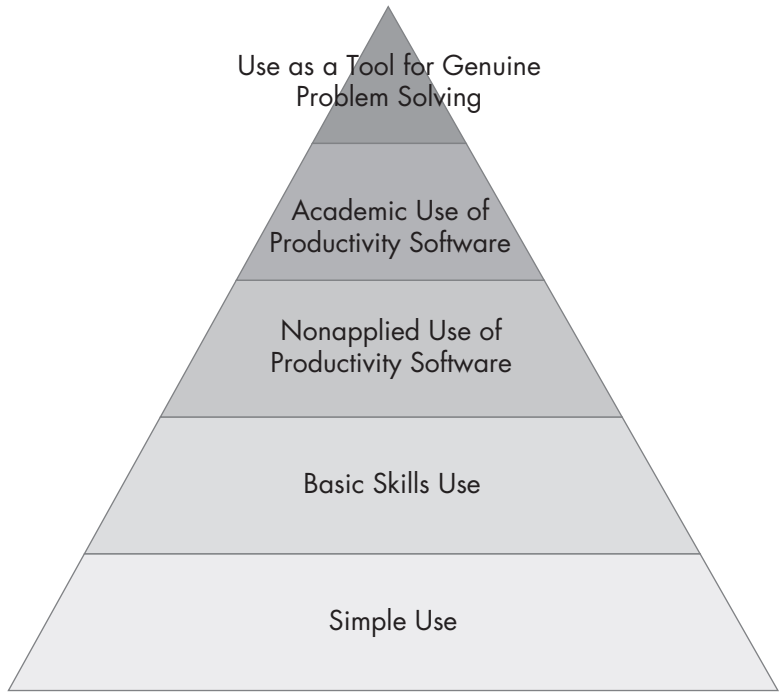
- ❑ **11.** Technology skill assessment as a part of the hiring process
- ❑ **12.** Training in electronic grade book use
- ❑ **13.** Training in curriculum system and student data-mining program use
- ❑ **14.** Training in student information system use for reporting grades and attendance reporting
- ❑ **15.** Training in creating online information for parents, students, and the community
- ❑ **16.** Training in creating distance learning opportunities (Web based, interactive television, or both) for teachers
- ❑ **17.** Available information about best practices in regard to the use of technology in the classroom
- ❑ **18.** Available information about new and emerging technologies and their educational applications

Again note that this lower level of technology use does not directly involve student use of technology. But it has a considerable impact on learning. Teachers who skillfully use technologies can improve traditional methods of instruction and model effective technology use for their students. Constructivist, problem-based units can certainly be designed that do not need technology, but such units can be greatly enhanced by its use.

EMPOWERED STUDENTS

All students will demonstrate the mastered use of technology to access, process, organize, communicate, and evaluate information in order to answer questions and solve problems.

When the basic needs of infrastructure, administration, resources, and teacher understanding are met, schools can provide students with successful technology-enhanced learning opportunities. Student use of technology can be viewed in a hierarchical arrangement as well:



Johnson's Hierarchy of Student Technology Use

Simple Use of Technology

Drill and practice software, integrated learning systems, computer-animated picture books, trivia recall games, and low-level problem-solving and simulation computer software have long been the mainstays of student technology use in most schools. These simple uses are also where a good deal of effort has gone in assessing the effectiveness of "educational computing," which has yielded poor, limited, or mixed results. The use of technology to teach basic skills, memorized facts, or low-level thinking skills, although at times motivational for students, is very expensive for the results achieved. The assessment of this use of technology really has to be an assessment of total student gain of basic skills, which is extremely difficult to determine for many reasons—the Hawthorne effect (results that occur simply because a topic is being studied), the bias of software producers who may be conducting the evaluations, a lack of resources for controlled study groups, and so on. Unfortunately, this technology use currently seems to be tainting decision makers' attitudes concerning all uses of technology in schools. And the actual computer skills students need to use these products are very limited: using a mouse to point and click.

Operational Skills Use of Technology

The second level of technology use is operational. Knowing how to turn on a computer or other piece of equipment, and being able to save files, to print, to adjust desktop settings, and to add or remove software, are skills necessary for

most independent computer users. In a school setting, however, many of these activities are restricted or at least discouraged. Management tools are designed to direct students straight to the applications they need without the distractions and possible damage to the operating system.

Nonapplied Use of Technology

Separate classes in "computer literacy" teach students at all grade levels how to use productivity software, such as word processors, databases, spreadsheets, presentation programs, multimedia authoring tools, e-mail, video production equipment, digital reference materials, electronic databases, and network search engines. Although all students should acquire such skills, these skills are somewhat meaningless and soon forgotten if they are not applied to a purpose.

Academic Use of Technology

Increasingly teachers are giving traditional assignments a technology "upgrade." Traditional tasks are completed using technology, and technology adds benefits to those tasks. Although a teacher's upgrading of traditional assignments with the judicious use of technology helps students apply computer skills and improves traditional instructional practices, it still does not tap into technology's potential to serve as a catalyst for pedagogical change, nor does such a scattershot approach guarantee that all students, regardless of teacher or program, will gain identified technology competencies.

Use of Technology as a Tool for Genuine Problem Solving

When students use technology as a tool for completing complex, authentic projects that ask them to solve genuine problems and answer real questions, technology reaches its most powerful instructional potential. This type of use requires students to complete tasks similar to those they will be asked to undertake in information-economy jobs—the kind of work that is better paying and gives greater job satisfaction and that will be the core of our economy both now and in the future.

But big challenges present themselves when technology is used on a large scale as an information processing tool. First, it requires a large investment of time and effort on the part of teachers in learning how to use it. Anybody can learn to operate drill and practice software in a few minutes, but learning to use a database to store, categorize, and sort information can literally take hours of instruction, weeks of practice, genuine effort, and guaranteed episodes of pure frustration. Teachers must spend additional time developing not only lessons that incorporate the computer skill into their specific subject areas but also units that have meaning for students, stress real-world applicability, and require higher-level thinking skills.

Second, the product of such instruction is not a neatly quantifiable indicator on an objective, nationally normed, quickly scored test. Conducting and assessing such projects require the ability to develop and apply standards; delay for long periods of time the satisfaction of task completion; and acknowledge and accept that conclusions, evaluations, and meanings that result from one's efforts are often ambiguous. It means that teachers have to see evaluation as a growth process, not a sorting process.

And finally, students need more than the twenty to forty minutes of lab access per week to learn these uses of technology. That means more equipment and software in more locations than if computers are used simply for accessing electronic worksheets or flash cards—or, increasingly, that means providing every child with a computing device.

Assessment of this technology use needs to be done less to satisfy a state department, legislature, or academic body than to inform the students themselves, their parents, and the community in which they live of student progress. It means school district curriculum departments undertaking the difficult task of creating benchmarks that describe the information and technology skills students are expected to have at various grade levels and designing the assessment tools needed to measure progress toward those benchmarks. It means finding ways to aggregate the assessed benchmark data to determine how well the entire program or school is doing. It means using technology to build personal portfolios of thoughtful, creative work that students and teachers can share with parents; to present worthwhile and authoritative reports to classmates; and to make meaningful efforts aimed at solving genuine personal, school, or community problems. It means adopting an approach to information and technology "literacy" for all students that is taken as seriously as is the teaching of reading, writing, and mathematics. It means being able to determine if the use of technology is making our children better citizens, better consumers, better communicators, better thinkers—better people.

As a teacher, use this checklist to determine how your district is meeting your student technology use needs:

- ❑ **1.** Integrated uses of school-adopted, stand-alone skill practice and simulation software titles to meet curricular goals

- ❑ **2.** Planned use of proven computerized instructional systems that have been formally adopted by curriculum departments
- ❑ **3.** Integrated curricular use of subject-specific technologies, such as science probes, graphing calculators, accounting software, computer-assisted design programs, and so on
- ❑ **4.** Planned use of adaptive technologies for students with special needs
- ❑ **5.** Planned use of reading promotion software
- ❑ **6.** Written information literacy skills curriculum that includes grade-level benchmarks (K–12) in research and technology use
- ❑ **7.** Units at each grade level that are team-taught by classroom teachers and library media or technology integration specialists and that are tied to the information and technology literacy curriculum
- ❑ **8.** Assessment tools for information literacy units
- ❑ **9.** Method of reporting students' attainment of information literacy and technology skills to individual students and parents
- ❑ **10.** Method of aggregating information literacy and technology skill attainment and reporting results to the school board and community
- ❑ **11.** Plan for continuous assessment and for revision of the information and technology literacy curriculum
- ❑ **12.** Plan for teaching and assessing safe and ethical technology use by students
- ❑ **13.** Opportunities for students to participate in distance learning
- ❑ **14.** Opportunities for students to experiment with new and emerging technologies and alternate uses of technologies as learning tools

A district that addresses each level of a technology hierarchy that is planned and shared with all school staff and the community can help answer and reduce statements like those that began this section on establishing framework for thinking about technology in schools. Such a framework can change the question from Should I use technology in teaching? to How can I use technology to improve the educational experience of my students? It can lead to better budgeting, more effective staff development planning, and an understanding by teachers and administrators of all the roles technology can play in helping make our schools more effective.

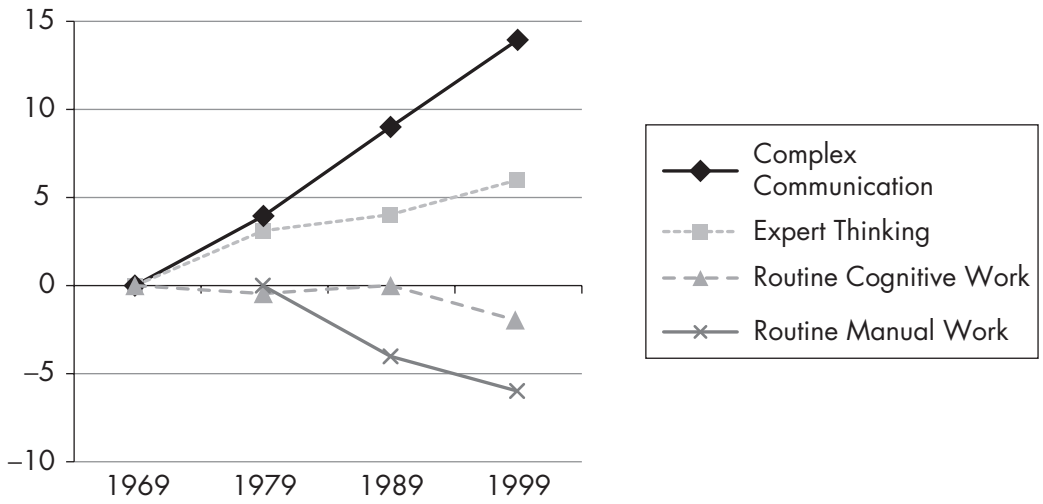
Gone Missing

There are a number of workers I rarely see anymore . . .

- I don't see parking attendants when entering or leaving a lot. My credit card talks to a machine on the way in and again on the way out.
- I don't talk to check-in people at the airline counters anymore. My credit card talks to a terminal that prints out my boarding pass. That is, if I haven't already checked in online and printed my pass at home.
- I am seeing fewer bank tellers and grocery store clerks. My debit card talks to the ATM and to the cash register at the supermarket after I have scanned my own groceries.
- My children think I am telling tall tales when I tell them I once had "people" who pumped my gas, washed my car windows, filled my tires, and sometimes gave me a free tumbler as a gift when I went to a *service* station.
- I don't hear the voice of a human telephone operator, tech support person, or reservation clerk until I've waded through a half dozen phone menus. And as often as not these voices are coming from Bangalore, India.

On the next page is a chart with the sexy title "Trends in Tasks Done by the U.S. Workforce 1969–1998 (1969 = 0)" from way back in 2004.

Parking lot attendants and their kindred who have gone missing fall into the "routine cognitive work" and "routine manual work" categories. The information that attendants and the like gave—and the processes they performed—were all standardized, multiple-choice answers, if you will. If any situation arose that called for something more than an A, B, C, or D response, a supervisor was found.



Trends in Tasks Done by the U.S. Workforce 1969–1998 (1969 = 0)
Source: **F. Levy and R. Murnane, "Education and the Changing Job Market,"** ***Educational Leadership,*** **October 2004, *62*(2), 81.**

So, a couple of questions . . .

1. Are teachers vulnerable to these shifts in the labor market? Will teachers who are only information dispensers, book readers, babysitters, and multiple-choice-quiz givers be automated and "go missing"?

   Have you asked yourself lately which of the tasks you spend your time on are routine? Do most things you do require professional judgment, problem solving, and, yes, creativity? What do you provide that an online resource can't?

   If *all* educators don't attend to adding value as expert thinkers and complex communicators, if they don't rebel against "teacher-proof" classroom models, fact-heavy mandated curricula, and objective basic skills testing as a sole measure of student performance, the deprofessionalization of our jobs may well come sooner rather than later.

   It's human nature to grouse a bit when confronted by a problem at work. Perhaps we ought to be grateful instead, if problems are what allow us to demonstrate our complex communication and expert thinking skills, which in turn helps to ensure our jobs.

2. Are we giving our students experience practicing "complex communication" and "expert thinking" skills in their assignments? Daniel Pink, in his book *Drive*

(2010), suggests that all teachers ask these questions about the homework they give (p. 164):

- Am I offering students any autonomy over how and when to do this work?
- Does this assignment promote mastery by offering a novel, engaging task (as opposed to rote reformulation of something already covered in class)?
- Do my students understand the purpose of the assignment? That is, can they see how doing this additional activity at home contributes to the larger enterprise in which the class is engaged?

If we genuinely believe future workers need to be creative problem solvers, why do we still give objective tests measuring the recall of trivia and only assess low-level, basic skills on such a regular basis? Do we construct information and technology literacy projects that honestly call for higher-order thinking skills—or are we asking only for a simple regurgitation of disassociated facts? Do we ask our students to communicate complex ideas and with complex media?

I keep thinking about a prediction made in the mid-1990s by a federal Department of Education official. She suggested that one day schools for the economically disadvantaged would be full of computers (drill and practice machines, programmed learning dispensers, evaluators), whereas wealthy schools would have human teachers (mentors, guides, challengers). Ironic at the time; more accurate today than we might think.

Those being trained by automatons to be automatons will be among the first to go missing in tomorrow's job market.