

STANDARDS for Technology-Supported Learning Environments



>>IT'S MONDAY.

Mr. Banks, an elementary school principal, greets his students as they disembark from the school bus. On the way to his office, he walks through the teachers' lounge to get a sense of the general mood of the day as the teachers sign in. After catching up on e-mail messages for the morning, Mr. Banks finds that he has time to drop in on Mrs. Tenny's fifth-grade class to observe her teaching. He grabs the lesson plan that Mrs. Tenny had submitted for the day and a copy of the standard teaching evaluation form. He walks down the hall to her classroom. As he enters, he sees the children working in groups. The objectives, written on the blackboard, indicate that the students are collaborating in groups to conduct research on American Revolutionary War heroes and that they will develop multimedia reports and presentations for sharing with the class at the end of the week. While walking around the room, he observes students referring to the computer-generated conceptual map they developed earlier as a guide for their reports, using the Internet to find information about their heroes, recording citations for the resources they use, collecting data and illustrations that they will

use in their multimedia presentations, and discussing who will complete which facets of their report and presentation.

>>MEANWHILE, Mrs. Tenny is moving from group to group, a personal digital assistant in her hand. She answers questions posed by the groups, suggests possibilities for new sources, reminds students of Internet search techniques, and occasionally makes entries on the hand-held device. As Mr. Banks surveys the learning environment, he sees a printer station with reminders posted above it explaining how to access the printer, and instructions regarding the "Good Citizen" checkpoints for leaving the printer station ready for the next users. He observes that the bulletin board is filled with student work related to the project the students are working on, and that the room with its five computers is arranged so that the students can easily form the clusters necessary for working in teams. Thirty minutes have passed, and Mr. Banks puts away the unmarked evaluation form and walks over to Mrs. Tenny, smiles, and whispers to her, "Thanks, I'll come back to evaluate another time, when you are teaching." >>

by Lajeane G. Thomas and Donald G. Knezek



>>Mr. Banks is obviously a leader who is kind and caring. He is “tuned in” to the needs of his students and teachers—and uses technology himself for administrative purposes. However, also obviously, he has not yet revised his traditional view of teaching to include teaching strategies associated with new learning environments that have evolved to accommodate integration of technology in the classroom. Mr. Banks seems to appreciate what the students and teacher are doing—but has not equated that with the criteria by which he should be assessing and evaluating effective teaching and learning.

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If our educational system is to address current needs for effective use of technology to support learning, our administrators—the principals, the district program directors, and the superintendents—must recognize the new tools and strategies for teaching, learning, and assessment and value them as effective models for facilitating improved student learning and significant pedagogical reform. With the infusion of technology, tools change, learning resources are different, and learning environments are transformed dramatically. Supported by modern information technologies, communication changes and decisions are made very differently. Teachers and administrators who understand technology and its roles in schooling and in society establish new priorities and highly value new learnings. >>

Figure 1
Establishing New Learning Environments Supported With Technology



The “good news” is that many of today’s administrators do understand technology and its role in teaching and learning. And many others realize that leadership development for education administrators is absolutely critical for preparing school leaders to understand how leadership can best leverage technology to benefit student learning and the multitude of important functions required to support that central concern.

>>Establishing New Learning Environments Supported with Technology

Through the ongoing use of technology in supporting content learning, students should be empowered to achieve essential technology capabilities. The key individual in helping students develop these capabilities is the classroom teacher. The teacher is responsible for establishing the classroom environment and preparing the learning opportunities that facilitate student use of technology to learn, communicate, and develop knowledge products.

Teachers must be prepared to empower students with the advantages that technology can bring. Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills. Real-world connections, primary source material, and sophisticated data-gathering and analysis tools are only a few of the resources that enable teachers to provide rich and powerful opportunities for conceptual understanding.

Traditional educational practices no longer provide prospective teachers with all the necessary skills for teaching students who must be able to survive economically in the global workplace. Teachers must prepare students to apply strategies for solving problems and to use appropriate tools for learning, collaborating, and communicating. As technology becomes a supportive resource for teaching and learning in the classroom, teachers move from traditional teaching strategies to strategies proven by research to promote more effective learning.

INCORPORATING NEW LEARNING STRATEGIES		
Traditional Learning Environments		New Learning Environments
Teacher-centered instruction	>	Student-centered learning
Single-sense stimulation	>	Multisensory stimulation
Single-path progression	>	Multipath progression
Single media	>	Multimedia
Isolated work	>	Collaborative work
Information delivery	>	Information exchange
Passive learning	>	Active/exploratory/ inquiry-based learning
Factual, knowledge-based learning	>	Critical thinking and informed decisionmaking
Reactive response	>	Proactive/planned action
Isolated, artificial context	>	Authentic, real-world context

Source: International Society for Technology in Education (ISTE), *National Educational Technology Standards for Teachers: Preparing Teachers to Use Technology* (Eugene, OR: ISTE, NETS Project, 2002).

Figure 1 above suggests that teachers plan learning activities that devote less time to the traditional learning activities found in the left column and more time to the corresponding strategies in the right column. The strategies suggested as indicative of New Learning Environments are described in research studies as more effective for improving student learning. Although the strategies in the right column do not specify use of technology, we know that technology used effectively best enables educators to achieve environments that support the powerful learning strategies listed. An understanding of how technology can support these new learning strategies may supply principals such as Mr. Banks with knowledge of the types of classroom teaching, learning environments, and experiences that are facilitative of improved student learning. This knowledge can influence decisions administrators make regarding not only teacher evaluation, but also a number of other conditions over which the administrator holds decision-making power.

>>ISTE National Educational Technology Standards (NETS)

Key tools in determining these decisions hinge on a knowledge and understanding of what students and teachers should know and be able to do. Performance expectations for students and teachers are revealed through sets of standards for subject areas—math standards, language arts standards, etc.—that policymakers, educators, and parents are now familiar with. We believe there must also be standards for educational technology, and the International Society for Technology in Education (ISTE) has now identified educational technology standards for students, teachers, and administrators. The remainder of this article presents an overview of these standards, and then looks in more detail at a set of “conditions” that policymakers and administrators must consider to ensure that their schools are able to successfully implement these standards.

>>ISTE National Educational Technology Standards for Students (NETS-S)

The ISTE National Educational Technology Standards for Students (NETS-S) identifies six major standards and related performance indicators, detailing what students should know about and be able to do with technology to support their learning, communications, research, problemsolving, and productivity (see Figure 2 at right).

Figure 2
ISTE National Educational Technology Standards for Students (NETS-S)

I. BASIC OPERATIONS AND CONCEPTS - Students demonstrate a sound understanding of the nature and operation of technology systems. - Students are proficient in the use of technology. II. SOCIAL, ETHICAL, AND HUMAN ISSUES - Students understand the ethical, cultural, and societal issues related to technology. - Students practice responsible use of technology systems, information, and software. - Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.	III. TECHNOLOGY PRODUCTIVITY TOOLS - Students use technology tools to enhance learning, increase productivity, and promote creativity. - Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works. IV. TECHNOLOGY COMMUNICATIONS TOOLS - Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences. - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.	V. TECHNOLOGY RESEARCH TOOLS - Students use technology to locate, evaluate, and collect information from a variety of sources. - Students use technology tools to process data and report results. - Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks. VI. TECHNOLOGY PROBLEM-SOLVING AND DECISION-MAKING TOOLS - Students use technology resources for solving problems and making informed decisions. - Students employ technology in the development of strategies for solving problems in the real world.
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Source: International Society for Technology in Education (ISTE), National Educational Technology Standards for Teachers (Eugene, OR: ISTE, NETS Project, 2000).

These “core” technology standards and indicators for students are accompanied by four profiles listing performance expectations of technology-literate students completing grades 2, 5, 8, and 12 (for more information, visit www.iste.org and select NETS).

>>ISTE National Educational Technology Standards for Teachers (NETS-T)

For teachers to be able to prepare their students for the applications of technology included in the student standards, they must be well versed in the use of technology themselves. The ISTE National Educational Technology Standards for Teachers (NETS-T) provides standards and indicators in six major categories (see Figure 3 on page 18).

In addition to the standards, NETS-T resources available online include related performance indicators, profiles addressing four benchmarks in preparation of new teachers, related assessment resources, and model lessons that integrate both subject area and technology standards (for more information, visit www.iste.org and select NETS). With these sets of standards in hand and the research supporting the establishment of new technology-rich learning environments, principals such as Mr. Banks will begin to understand what should be expected of children in each grade range, to plan for the types of technology-related curricular resources necessary for their schools, and to acquire facilitative software for both the students and the teachers. Principals

will recognize effective uses of technology to support learning and teaching in their schools, and gear the evaluation and assessment practices around expectations gleaned from the subject area and technology standards. Armed with this knowledge, school leaders will begin to understand what other systems in their schools, such as modern school libraries, can be in this new model of schooling.

>>ISTE National Educational Technology Standards for Administrators (NETS-A)

A third set of related standards, developed by the Technology Standards for School Administrators (TSSA) Collaborative and adopted as the ISTE National Educational Technology Standards for Administrators (NETS-A), provides a core foundation of expectations for all administrators with regards to effective integration of technology in school settings. These standards identify what every education administrator should know and be able to do with technology. Six standards are identified as the core expectations for all administrators (see Figure 4 on page 19).

Additionally, there are specific profiles that identify performances that are expected of administrators in each of the following three job roles: (1) a superintendent or assistant superintendent, (2) a district or central office program director, and (3) a principal or assistant principal. These standards would assist a building administrator such as Principal Banks in understanding his role and how it is affected by the infusion of technology in the school setting.

When the implementation of a technology initiative is problematic, often a major reason cited is a breakdown in the common understanding of the institution's goals among those who hold the decision-making power.



>>Essential Conditions Supporting Standards Implementation

As an administrator considers all of these sets of standards—for students, for teachers, for administrators—it is clear that immediate and long-range planning must occur. There are several conditions that must be considered when planning for implementation of these standards.

Realizing the expectations, ISTE provides additional tools that will help administrators plan for the essential conditions necessary to support these new learning environments. If the standards for teachers and for students are to be met, certain essential conditions must be in place to support the expected outcomes. These essential conditions identify major considerations when planning for effective integration of technology in schools and universities.

When planning for implementation of technology in schools and teacher education, the planning team should consider each essential condition and note whether, and to what extent, it is present. The context, culture, and extent of collaboration among stakeholders will affect how adequately the conditions are met. These will also determine what types of strategies might be used to solicit support if the essential conditions are not currently in place. Because of their importance in the process of integrating technology, each condition is examined separately in this section.

>>Shared Vision

Policymakers and administrators provide proactive leadership in developing a shared vision for educational technology among school personnel, parents, and the community—shared understandings and

beliefs surrounding what benefits technology will bring and how those benefits will be realized. Defined as the presence of proactive leadership and administrative support, shared vision means that the commitment to technology is systemic. From the state education department to school administrators to the school grounds personnel, there is an understanding of, commitment to, and sense of advocacy for the implementation of technology. When the implementation of a technology initiative is problematic, often a major reason cited is a breakdown in the common understanding of the institution's goals among those who hold the decision-making power. These situations can occur over something as simple as unlocking the door to a lab, or as complex as modifying operational budgets to provide allocations for technology funding. Facilitating the integration of technology may require a change in policy or rules, and the decisionmakers have to be willing to look at the situation, forge compromises when necessary, and ensure communication among all parties. The collaborative environment necessary for creating a shared vision is also necessary to sustain that vision.

>>Equitable Access

The fact that educators need access to current technologies, software, and telecommunications networks seems simple. However, this access must be consistent across all the educational environments—those supporting administrators, teachers, and students. Most teacher education programs, for example, involve several entities, including at least a college or university and one or more schools in the P-12 range. Creative partnerships are often required to facilitate equitable access across the spectrum of educational experiences.

Figure 3
ISTE National Educational Technology Standards for Teachers (NETS-T)

ALL CLASSROOM TEACHERS SHOULD BE PREPARED TO MEET THE FOLLOWING STANDARDS:

I. TECHNOLOGY OPERATIONS AND CONCEPTS

Teachers demonstrate a sound understanding of technology operations and concepts.

II. PLANNING AND DESIGNING LEARNING ENVIRONMENTS AND EXPERIENCES

Teachers plan and design effective learning environments and experiences supported by technology.

III. TEACHING, LEARNING, AND THE CURRICULUM

Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning.

IV. ASSESSMENT AND EVALUATION

Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies.

V. PRODUCTIVITY AND PROFESSIONAL PRACTICE

Teachers use technology to enhance their productivity and professional practice

VI. SOCIAL, ETHICAL, LEGAL, AND HUMAN ISSUES

Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK–12 schools and apply that understanding in practice.

Source: International Society for Technology in Education (ISTE), *National Educational Technology Standards for Teachers* (Eugene, OR: ISTE, NETS Project, 2000). This chart includes the standards, but not the performance indicators, that go with each standard. For the complete document, go online to cnets.iste.org/index3.html.

Figure 4
ISTE National Educational Technology Standards for Administrators (NETS-A)

Developed by the TSSA Collaborative and adopted by ISTE NETS

I. LEADERSHIP AND VISION

Educational leaders inspire a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of that vision.

II. LEARNING AND TEACHING

Educational leaders ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching.

III. PRODUCTIVITY AND PROFESSIONAL PRACTICE

Educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others.

IV. SUPPORT, MANAGEMENT, AND OPERATIONS

Educational leaders ensure the integration of technology to support productive systems for learning and administration.

V. ASSESSMENT AND EVALUATION

Educational leaders use technology to plan and implement comprehensive systems of effective assessment and evaluation.

VI. SOCIAL, LEGAL, AND ETHICAL ISSUES

Educational leaders understand the social, legal, and ethical issues related to technology and model responsible decision-making related to these issues.

Source: International Society for Technology in Education (ISTE), *National Educational Technology Standards for Administrators* (Eugene, OR: ISTE, NETS Project, 2002). This chart includes the standards, but not the performance indicators, that go with each standard. For the complete document, go online to cnets.iste.org/tssa. This material was originally produced as a project of the Technology Standards for School Administrators Collaborative.

Additionally, there needs to be access to technology resources appropriate to the subject areas being studied, such as word processing programs and Internet access in language arts, or computer labs and microscopes for science labs. Access must be in classrooms as well as lab settings, and provisions must be made for special populations. The technology should be accessible immediately when it is the best route to the information or tools needed by students, practicing and future teachers, and administrators. Furthermore, model classrooms, including at least a presentation system and four to six stations, can facilitate effective use of technology to support student learning.

Access to technology for administrators and staff in a school district is also an essential condition for implementing effective technology integration. While a job role does determine the extent to which technology access is needed, the district environment must provide appropriate opportunities for all employees.

>>Skilled Personnel

The district leaders, support personnel, practicing teachers, and teacher educators must be skilled in the use of technology for learning. They must be able to apply technology in the presentation and administration of their coursework and facilitate the appropriate use of technology by their students or teacher candidates. Current and future teachers must work with mentors as they model and teach techniques for managing technology in the classroom and for communicating outside the classroom through electronic means. Administrators and support personnel should use technology as is appropriate for their job role. Technology standards should be used as one criterion when reviewing applications for hiring new teachers, administrators, and support personnel.

>>Professional Development

Even in contexts in which professional preparation and competence is exceptional, it is important to provide consistent access to pro-

fessional development as the technology constantly changes. Ongoing opportunities for professional development should be available to faculty, administrators, and support personnel at all levels. Professional development is not a one-time event—it should be focused on the specific needs of individual staff and sustained through coaching and periodic updates. The district plan should outline opportunities afforded within the system to teachers, district leaders, and support personnel for learning job-specific technology skills.

>>Technical Assistance

Educators need technical assistance to use and maintain technology. The focus of the education professional should be on teaching and learning, not on maintaining and repairing the technology beyond basic trouble-shooting procedures. When the technology does not function well, a learning opportunity is lost and educator frustration grows. It is critical that district (and university) leaders understand the negative effects that an unanswered need for technical assistance can have on the attitudes towards technology use. It is also critical that they are aware of options for providing timely technical assistance.

>>Content Standards and Curriculum Resources

Educators must be knowledgeable in the content, standards, and teaching methodologies for their disciplines. Practicing and prospective teachers must learn to use technology in powerful, meaningful ways in the context of teaching content. Technology brings relevant resources from the real world, provides tools for analyzing and synthesizing data, and conveys content through a variety of media and formats. Teachers should learn to use technology in ways that meet the content standards and the technology standards for students and teachers. Administrators must be aware of the variety of applications of technology for teaching, learning, and management, and must expect that technology will be used to support learning in all curriculum areas. The

savvy school librarian or library media specialist can be a strong ally to teachers and administrators in locating, reviewing, and providing engaging, standards-based, and technology-rich content resources.

>>Student-Centered Teaching

Teaching in all settings should encompass student-centered approaches to learning. Technology should not be used only for demonstration as an electronic overhead projector or blackboard; rather, the use of technology by students should be an integral part of instruction. In student-centered approaches to learning, students become the source for problems investigated as well as for resources brought to the solution. Students and teacher candidates must have opportunities to identify problems, collect and analyze data, draw conclusions, and convey results using electronic tools to accomplish these tasks. Staff development leaders and teacher educators should model the use of technology to demonstrate its usefulness and appropriateness for collaboration, acquisition of resources, analysis and synthesis, presentation, and publication. Administrators should recognize student-centered, collaborative work as research-proven strategies for student learning. They must also recognize promising strategies for use of technology to improve student learning and commend teachers who are successfully applying technology to facilitate such strategies.

>>Assessment and Accountability

In addition to assessing teaching and student outcomes, institutions and professional development programs should continuously assess the effectiveness of technology for learning throughout the teaching and teacher development environment. The data obtained from this continuous assessment will: (1) inform the learning strategies used; (2) ensure that the vision for technology use maintains the appropriate direction; (3) pinpoint potential problems; and (4) provide data for altering policies and instructional strategies and for acquiring resources. Changes made over time due to technology innovation should exemplify informed decision-making. Administrators should recognize opportunities for collecting and analyzing data for use in making informed decisions about improvement of teaching and learning strategies.

>>Community Support

The visioning process includes the community and school partners who provide expertise, support, and resources for technology implementation. The community must see that technology is a valuable tool for teachers and their students, and must be willing to support it in the political process from the boardroom to the state house.

>>Support Policies

Policies can either support or hinder the implementation of technology. As decisionmakers develop new policies, they must consider how the policies affect acquisition of, and access to, technology. Some major barriers to the use of technology relate to teacher and faculty expectations about incentives and reward structures. The expectation for the use of technology must cut across all subject areas and all teaching-learning contexts so that educators and future educators are assured that their work will be valued.

Policies related to technical assistance should also support the use of technology rather than obstruct it. For example, although firewalls are essential in the educational environment, there are ways to provide dial-up and remote access while maintaining the security of central servers.

Likewise, at the school level, there are ways to control students' Internet access to unwanted images and information while maintaining an environment of exploration, inquiry, and progressive self-responsibility.

>>External Conditions

External conditions that affect a school district include various strategies and programs initiated at all levels of the educational and political system. Policies, statutes, requirements, and initiatives at the national, regional, and state levels support the district in the effective implementation of technology for achieving national, state, and local curriculum and technology standards. Administrative leaders are responsible for implementation of these strategies and programs in school districts and in teacher education and professional development programs.

System conditions related to access and connectivity, supportive policy, modern infrastructure and technical support, expectations of continuous improvement, standards-based curriculum, student-centered learning activities, and community support are priority concerns of the administrator committed to providing necessary system support to achievement of expectations with technology.

>>Conclusion

Effective technology leaders understand the roles technology plays in schools and in society. Through an emphasis on standards and benchmarks, the administrator clearly and frequently reminds all involved of the expectations related to technology.

With technology investments in education running in the billions, with the continuing need for educated and ever-learning workers, and with the enduring dream of universal preparation of young learners for a contributing and satisfying role in their information and technology-laden futures, we as educational leaders should feel both the internal and external motivation to grow, to learn, and to lead.

Technology changes the equation of effective and efficient schooling. Used across a school system, technology both enables and causes change in tools, in communications, in planning, in operations, in management, in decisionmaking, in curriculum, in teaching, and in learning. It also presents challenges in safety and security, and it refocuses schooling on ethical and legal behaviors. Education administrators, like Mr. Banks, must grasp the magnitude of this professional challenge in leadership for schools. The effective leader must ensure a shared vision among all stakeholders that succinctly captures the expectations of the school community to focus technology use in the enterprise of schooling.

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References cited:

- International Society for Technology in Education (ISTE). *National Educational Technology Standards for Administrators*. Eugene, OR: ISTE, NETS Project, 2002.
- International Society for Technology in Education (ISTE). *National Educational Technology Standards for Teachers*. Eugene, OR: ISTE, NETS Project, 2000.
- International Society for Technology in Education (ISTE). *National Educational Technology Standards for Teachers: Preparing Teachers to Use Technology*. Eugene, OR: ISTE, NETS Project, 2002.
- Sivin-Kachala, K. and E.R. Bialo. *2000 Research Report on the Effectiveness of Technology in Schools*. Washington, DC: Software and Information Industry Association (SIIA), 2000.
- Software and Information Industry Association (SIIA). *SIIA Trends Report 2001: Trends Shaping the Digital Economy*. Washington, DC: Software and Information Industry Association, 2001.