DOCUMENT RESUME

ED 402 686 EA 028 154

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TITLE Systemic Planning for Technology.
INSTITUTION Oregon School Study Council, Eugene.
REPORT NO ISSN-0095-6694
PUB DATE Jan 97
NOTE 39p.
AVAILABLE FROM Oregon School Study Council, 1787 Agate Street, College of Education, 5207 University of Oregon, Eugene, OR 97403-5207 ($7 nonmember; $4.50 member; quantity discounts).
PUB TYPE Collected Works - Serials (022) -- Information Analyses (070) -- Guides - Non-Classroom Use (055)
JOURNAL CIT OSSC Bulletin; v40 n2 Jan 1997

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Computer Assisted Instruction; Computer Uses in Education; Educational Objectives; *Educational Planning; *Educational Technology; Elementary Secondary Education; *Integrated Learning Systems; Master Plans; Needs Assessment; Organizational Development; School Districts; School Restructuring; *Systems Development; *Technological Advancement
IDENTIFIERS *Oregon

ABSTRACT

Technology and structural change in education are inextricably linked. That is, schools generally need to change the way they do things to take full advantage of technology, and the use of technology tends to change what happens in schools. This report examines recent theory and practice of schools and school districts planning for educational technology, focusing on using a systemic approach to technology planning. Educational technology refers to software and hardware that are used to assist, present, or assess teaching and learning. Chapter 1 presents the case for making technology planning part of a larger effort to anticipate, coordinate, or create change. Chapter 2 reviews some common planning practices, followed by a short checklist for the planning process. Chapter 3 offers examples of systemic plans for technology developed by Oregon districts. Some of the material was drawn from interviews with six directors or coordinators of technology planning. The focus throughout is on technology planning as a concrete process that results in a technology plan. (Contains 40 references.) (LMI)

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January 1997 • Volume 40, Number 2

OSSC BULLETIN

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ISSN 0095-6694
Nonmember price: $7.00
Member price: $4.50
Quantity Discounts:
10-24 copies - 15%
25-49 copies - 20%
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Preface

The relationship between technology and education is complex. Because of the dramatic changes brought about by computers and communications, most people recognize that technology needs to play a role in school. Yet the effects of using technology in instruction are varied. Some programs show increases in academic achievement for students using technology; others do not. Compared to information-based workplaces, there is an obvious shortage of technology in schools, yet stories also abound of unused or underused classroom computers.

In the mid-1990s, a consensus began to emerge in various reports and research that the issues of how to use and assess technology were part of larger questions about restructuring education to meet the needs of students in a changing world. The complex relationships among teaching, learning, and technology could not be understood outside this context. This Bulletin presents the argument for this systemic approach to technology planning, along with discussion of current plans from Oregon school districts. It provides members of planning teams with practical guidelines for developing or revising their own district or building plans.

These guidelines were reviewed by a number of technology planners, including Arlen Sheldrake of the Multnomah County Education Service District, Paul O'Driscoll of Salem-Keizer Public Schools, Dr. Larry Anderson of the National Center for Technology Planning, Dr. David Moursund of the International Society for Technology in Education, and attendees of the Oregon School Study Council meeting in Portland, Oregon in November 1996.

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Contents

Introduction

This Bulletin examines recent theory and practice of schools and school districts planning for educational technology. *Educational technology*, for purposes of this Bulletin, includes software and hardware—computers, peripheral digital devices, video and audiotape, networks—that are used to assist, present, or assess teaching and learning. It does not include educational data processing or management-information systems by themselves, though in some networked computing environments those functions may be tied in with classroom computing.

This Bulletin also concentrates on *systemic planning*; that is, planning that addresses more than the technical issues of installing computers and networks, and more than the scope and sequence of the instruction that will make use of the technology. This approach is taken because the weight of research and opinion today indicates that installing and using technology in schools is one component of restructuring education. That is, schools generally need to change the way they do things to take full advantage of technology, and the use of technology tends to change what happens in schools.

Michael Holzman (1993) points out that the word *systemic* is used in at least five ways in the school-change literature. It can mean affecting entire systems, affecting all schools in a system, affecting all aspects of a system, "systematic," and "fundamental." Holzman believes genuine systemic change encompasses all five shades of meaning, and this Bulltein considers examples of technology planning in that light.

At the same time, not all technology planners have access to entire school systems, but they are still pressing ahead to change the part of their world that they can affect. As Howard Mehlinger (1995) notes, the technology revolution has been a grass-roots effort, often initiated by teachers and building-level school administrators. This Bulletin is intended to inform local planners as well as district or regional policy-makers. At some point, all these individuals may end up on the same planning team.

To review all the pressures for fundamental change in education is behond the scope of this Bulletin. Suffice it to say that this Bulletin does *not* assume that systemic change is good in and of itself, only that, at this point in history, many thoughtful observers both inside and outside the educational system have concluded that schools need to adopt the tools and techniques commonly used elsewhere in society to learn, create, and communicate. What is assumed is that pressure to change—in particular, to adopt new computer technologies—will not go away, and that educators need to plan accordingly.

Chapter 1 presents the case for making technology planning part of a larger effort to anticipate, coordinate, or create change. Chapter 2 reviews some common planning practices, followed by a short checklist for the planning process. Chapter 3 offers examples of systemic plans for technology developed by Oregon districts. The focus throughout is on technology planning as a concrete process that results in a document, a technology plan, which—depending on the quality of the work—may either sit unread on a shelf or guide the daily activities of thousands of learners.

Chapter 1

Technology and Restructuring

The essential argument of this Bulletin is that technology and structural change are inextricably linked. Each is essential to the other. This chapter reviews some of the recent literature to support this perspective.

A pair of well-publicized U. S. government reports present two aspects of the case for making technology part of systemic planning for school change. In 1993 the U.S. Department of Education's Office of Educational Research and Improvement (OERI) published *Using Technology to Support Education Reform*. Based on an extensive literature review, author Barbara Means and her colleagues maintained that "technology supports exactly the kinds of changes in content, roles, organizational climate, and affect that are at the heart of the reform movement." Those changes, according to the OERI report, include student exploration, interactive modes of instruction, extended blocks of authentic and multidisciplinary work, collaborative work, teacher as facilitator, heterogeneous student groupings, and performance-based assessment.

In turn, certain organizational conditions are necessary for teachers to make effective use of technology. In addition to such logistical provisions as training time and technical support, these conditions include "policies that include teacher experimentation and collaboration, the presence of incentives for teacher use of technology, administrative leadership about technology, and public understanding and endorsement of technology as a learning and teaching tool" (Office of Technology Assessment 1995). The two conditions given most attention in the OTA report are "having a vision and plan for using technology to meet instructional and professional goals, and evaluation and assessment policies that encourage technology use."

Technology, Teaching, and Learning

Systemic changes are both supported by, and necessary for, effective educational technology. Some educators believe the failure to integrate technology and school restructuring or systemic reform explains the often inconsistent results from studies of computer use and student achievement.

Educational researcher and futurist Chris Dede says,

> If technology is simply used to automate traditional models of teaching and learning, then it'll have very little impact on schools. If it's used to enable new models of teaching and learning, models that can't be implemented without technology, then I think it'll have a major impact on schools. (quoted in O'Ñeil 1995)

Although technology is cited as the key to accessing new sources of information, the simple quantity of information is not the issue, Dede says. The conventional classroom already has access to more information than people can use. Technology's role lies in making possible learning environments that have not been practical before:

> Many of the things we've been talking about—collaborative learning, constructive learning, and apprenticeships—are not new concepts in learning. But they've never been sustainable. (Dede in O'Neil)

Technology can help establish a supportive infrastructure that makes it possible to use those powerful models without burning out.

Part of this restructuring for new learning environments needs to occur at the classroom level. Critiques of early metastudies on computer-assisted instruction found that teacher presentation had a profound effect on outcomes, essentially eliminating any clear effect of technology by itself. (See Ann Roblyer's September 1996 column in *Learning and Leading with Technology* for an excellent summary of this ongoing debate.) As Larry Miller and John Olson (1995) point out, "If the writer's workshop is not a natural component of the curriculum, introducing a sophisticated word processing package will not automatically foster a writing process approach in the language arts classroom." Automatically, no—but technology in the classroom can promote new ways of teaching and learning in a supportive school environment.

In discussing research on integrated learning systems—networked curriculum and instructional-management packages—researchers Lani Van Dusen and Blaine Worthen (1995) write,

> The role of the teacher changes dramatically in the well-managed ILS classroom. . . . They act as facilitators and organizers of learning activities; they are free to focus on small groups and individuals who need more specialized attention; and they can coach their students in how to process information, helping them to make choices and validate their learning. . . . Our studies have shown that the extent to which the teacher integrates the ILS and classroom content is the most important factor in producing student learning gains. Unfortunately,

> most teachers see the ILS as a supplement to, rather than an integral part of, the classroom.

The level of integration Van Dusen and Worthen have in mind requires hard work and a certain amount of courage to achieve. It requires accepting the computer-presented curriculum in the same way a teacher would adopt a favorite textbook. On the one hand, teachers must become familiar enough with the software and the way it presents the content that they can provide guidance or interpretation at any point. On the other hand, teachers must have enough faith in the system to fully implement it and let students work independently. Otherwise, the classroom never reaps the benefits of having a teacher who is free to concentrate on individual student needs.

Add-on vs. Change Agent

Educational technology has suffered from being a poorly integrated "add-on" for many years. Early approaches that used computer labs only as alternatives to conventional workbooks have given way to greater integration of the computer as a tool across the curriculum, via the use of major standard applications such as word processors, spreadsheets, and databases. However, that may be a difference in degree, not in kind. Chris Morton (1996) argues that considering computers everyday tools like pencils and paper also relegates them to being one tool among many alternatives, rather than an essential part of a modern learning environment.

> Educational administrators must understand that the promise of computer environments is that they support changes in the educational structure, in instructional processes, and in the development of lifelong learning within the whole population. We all pay lip service to the importance of changing these features of the American educational landscape. But it takes leaders with guts to pursue these future visions and to develop truly innovative learning environments that serve the whole community.

"Guts" are necessary because education is what Moursund and Ricketts (1988) describe as an "essentially contested concept." The full integration of technology in education requires not only changes in the attitudes and practices of educators (who may at least share a common knowledge base), but changes in the attitudes of taxpayers, policy-makers, and private funders who may have very different concepts of what does or should go on in classrooms, what outcomes are desirable, and how those outcomes should be assessed. The comprehensive nature of the undertaking and the many opportunities for resistance demand that educational technology planners take into account a variety of educational stakeholders and a range of activities, from conceiving a vision through evaluating results. In other words, they must think and act in a systemic manner.

Chapter 2

Systemic Planning

Many educators and educational supporters in the community will have practical experience in school planning. The discussion below relates some common planning techniques to the special issues surrounding technology.

While the specifics of carrying out a technology plan vary widely across schools and districts, the planning process usually entails several general steps. A typical sequence is suggested by David Moursund and Dick Ricketts (1988):

1. Evaluate the situation.
2. Articulate a vision.
3. Decide on a mission statement.
4. Develop goals.
5. Develop a strategic implementation plan, including short- and medium-range plans.
6. Set up a procedure for assessment and periodic revision of the plan.

Initial Evaluation and Needs Assessment

The involvement of key stakeholders from the outset is crucial to ensure that everyone involved will help make the technology plan work. A conventional strategy is to establish an inclusive committee to prepare a plan. Another approach, more focused on the ongoing need to maintain technology, is to establish a standing technology advisory committee (Tackett Austin and others 1993).

In any case, the inclusive discussion needs to be moderated by a strong leader. According to the National School Boards Association (1995), "A major barrier in the path of bringing schools into the Information Age is the lack of visionary leadership on the part of school leaders." Microsoft Corporation, in its school-technology planning guide, recommends that the leader of a planning effort be at a high enough level to address systemwide needs and help ensure endorsement and funding. At the same time, the leader needs to have respect and influence in both administrative and instructional areas.

This is a demanding assignment. Lajeane Thomas and Don Knezek (1991) surveyed administrators about the importance of thirty-three competencies for technology leadership. The list included skills as diverse as grant seeking, student assessment, e-mail, project management, desktop publishing, and public relations. The researchers found that virtually all the skills were considered essential. (The only competency *not* seen as important enough to require mastery or at least practical experience was "transportation management.") Microsoft suggests that joint leadership by a teacher and administrator may be necessary to cover the required fields of experience and ensure schoolwide acceptance of a plan.

Visions and Goals

As a committee moves from needs assessment into visions and statements about change, planners should heed several caveats. One is that stakeholders should continue to have a voice in decisions rather than only token representation. Valerie Romney (1996) urges planners to devote considerable research to needs assessment prior to visioning and goal-setting, using a variety of information sources, such as surveys and Delphi consensus-building procedures. Thomas Reeves (1992) also suggests various activities to help with ongoing goal refinement, including focus groups, document analysis, interviews, questionnaires, and expert reviews.

This effort to achieve consensus is particularly important given the typically divergent opinions of different stakeholders who have to cooperate to design, fund, and implement a plan. While educators may look to technology to help them implement problem-solving curricula, whole language, mixed-ability levels, and student portfolios, a 1994 report by Jean Johnson and John Immerwahr found that

> the large majority of Americans are uncomfortable with many of these changes. Overall, the public seems to have a more traditional view of what should be happening in the classroom. They want to see students learning some of the same things—in the same ways—that they learned in school.

Thus a great challenge is to make the visioning process systemic—in Holzman's sense of *fundamental* (see the Introduction). Bela Banathy (1991), gives examples of typical "reform" questions, such as What is wrong with the system? and How can we improve student and teacher performance? Banathy claims that such questions, and the responses they elicit, only address how to do "more of the same," without examining whether the system is viable in the first place. As Roger Kaufman (1992) states,

> Education still attempts to do better by working harder and spending more instead of by defining what its business is. . . . We are working as hard now as we know how to work. But that won't improve education's contributions to learners or our shared world.

In contrast, a more systemic approach begins by asking what the nature of the environment is and what role we expect education to play. Banathy would have planners begin with questions such as "What is the nature. . . of the current post-industrial information age?" Striving for such a broad social perspective may seem like a waste of time to a committee charged with spending a specific technology budget by the end of the fiscal year. Kaufman suggests starting out by identifying the scope of desired results as mega-level (societal), macro-level (school or district), or micro-level (individual or small group). However, he also recommends addressing all levels, to avoid plans being reactive, quick-fix solutions to problems that will recur.

Jane David (1994) states, "The primary reason technology has failed to live up to its promise is that it has been viewed as an answer to the wrong question. Decisions about purchases and uses of technology are typically driven by the question of how to improve the effectiveness of what schools are already doing—not how to transform what schools do."

At the school or district level this translates into considering the instructional goals before the technology goals. As David Thornburg (1994) states,

> Curriculum and pedagogy must drive technology use. Technology implemented in the absence of a broader plan almost always leads to disaster. One advantage that comes from placing technology in its proper perspective is that technology purchases will have long-term value in the face of constant price/performance improvements.

Budget

Educational-technology advocates have long argued for a standing appropriation for technology in school budgets. Various proportions have been suggested, from 2 percent of per-pupil expenditure (Thornburg 1994), to 3 percent of total operating budget (Morton 1996), to 5 percent of per-pupil expenditure (Moursund 1993), to what works out to about 15 percent of

1994 per-pupil expenditures (Becker 1993). The exact amount will vary with the community and school, but the argument is that technology requires an ongoing investment. Providing computers and software only through occasional bond measures leaves the technology vulnerable to breakdowns and obsolescence from lack of maintenance, and to disuse from lack of staff training.

Another factor to consider in budgeting is the time required to implement systemic change. Simply installing technology, as in the dramatic NetDay wiring of schools, can be accomplished in a short period. Actually integrating that technology in instruction will take years—three to five is a frequently projected timeline. This not only has implications for the length of financial commitment, but also for evaluation. Taxpayers and policy-makers not involved in the planning process may expect to see positive changes in student achievement during the first school year after they have put up the money to fund a technology plan. Yet at that point, teachers and students will likely still be struggling to incorporate the new tools into the school day. If only for public-relations purposes, planners will need to consider how to report progress along the way.

Evaluation from the Beginning

Evaluation is almost always listed at the end of the planning process, yet to be meaningful, thought needs to be given to this element at the vision and implementation stages. For instance, Van Dusen's and Worthen's research on integrated learning systems indicated that students need to spend thirty minutes per day per subject on computers to achieve significant learning gains. A school that invests in an ILS that each student can access only thirty minutes per week may have doomed the program to failure before a single machine is installed.

Establishing that there is a need for evaluation is one challenge. Designing the evaluation component is another. In critiquing its own technology plan, the state of Tennessee reported, "Currently neither the department nor the board has a detailed technology policy indicating what will be achieved with technology and how it will be measured. Implementing technology without clear and measurable educational goals may result in millions of dollars spent without quantifiable results."

Selecting "quantifiable results" that will satisfy a range of stakeholders is a formidable task. Critics of standardized testing, such as Grant Wiggins (1993), have been urging educators to employ more authentic forms of assessment for years. At the same time, standardized achievement tests continue to be important in guiding educational policies, and as a way of reflecting the results of innovations. Not understanding or agreeing on the significance of these different measures may lead, at the very least, to confusion about whether a plan is working.

For example, when Oregon statewide math-assessment scores were released in 1996, varying interpretations of their meaning were forthcoming. The state superintendent of schools made a public statement decrying the failure of the state's reform effort. On the other hand, a *Register-Guard* (Eugene, Oregon) editorial suggested that the scores, which showed little change over the course of the reform effort, actually indicated success, given the massive budget cuts the educational system had endured during the same period. Interpretation was further complicated by the release that same week of Scholastic Aptitude Test results, in which scores of Oregon seniors were among the highest in the nation.

Karen Sheingold and John Frederickson (1994), considering the issue of evaluation in new technology environments, write that if assessment is to be linked with reform, it must be viewed as a social process grounded in:

- Conversations about student work as evidence of learning and accomplishment
- Development of a common language for discussing learning, accomplishments, and standards
- Development of shared values and transparent criteria for evaluating student work

In supporting this view of assessment, technology has five functions, according to Sheingold and Frederickson:

1. Support students' work in extended, authentic learning activities
2. Create portable, accessible copies of performances and replay performances in multiple media
3. Provide libraries of examples and interpretive tools
4. Expand the community of assessment participants
5. Publish selected student work and thus recognize accomplishments

Specific assessment standards for technology access and skill may seem difficult to achieve during such rapid change. For instance, technology plans from 1991 to 1994 collected by the National School Boards Association frequently talk of establishing a few CD-ROM "stations" and barely mention the Internet. As of this writing, CD-ROM drives are standard on new computers, and World Wide Web browsing and authoring are emerging as important research and communication skills.

Despite the difficulty of predicting changes in equipment and software, the National Council for the Accreditation of Teacher Education, the International Society for Technology in Education, and other organizations are working to develop national standards for technology use in schools (ISTE 1996). This ongoing effort follows the lead of curriculum-area standards such as those of the National Council of Teachers of Mathematics, and will facilitate the development and assessment of technology programs in the years ahead.

Implementation, Assessment, and Revision

Examples of technology planning and implementations by schools are described in the next chapter. However, in the planning stage, it is important to keep in mind what Michael Fullan refers to as an *implementation perspective.* That is, educational technology is not going to be a treatment that is provided or administered to students, and from which they emerge at certain grade levels with higher or lower test scores. The details of how the plan is implemented and how the various stakeholders work together is essential to understanding why a plan achieves or fails to achieve its objectives. Seymour Sarason (1990) has pointed out that such knowledge is also essential if a successful plan is to be replicated in other schools or districts. Too often, according to Sarason, educational reformers merely imitate a successful program without being aware of conditions that might be crucial to the program's success. Van Dusen and Worthen's research on Integrated Learning Systems, mentioned earlier, is a case in point.

Moursund and Ricketts describe a strategic implementation process that involves ongoing formative evaluation of intermediate goals and the methods used. The stakeholders are then in a position to make changes as necessary. Toward the end of the planning period (typically three to five years) a summative evaluation produces conclusions and judgments that become part of the needs assessment for future planning.

The constant process of planning, implementation, and feedback can demand a great deal of time from the teachers and administrators involved, sometimes more than planners project at the outset. Ongoing research by the author and others (Moursund and others 1996) involves teams from twenty-two school/community partnerships participating in a two-year technology grant. The teams spent most of a year in planning, including complete revision of their initial proposals under guidance of consultants and mentor educators provided by the funder. In mid-program, when asked what changes they would like to make, teams frequently responded that they needed to build in more time during the week for planning.

A grant provides for some new computers and training; developing and carrying out activities using the new technology requires teachers to assume new responsibilities for curriculum, hardware maintenance, and coordination with the community outside the school. To support these responsibilities, administrators may need to adjust school schedules, teacher assignments, budget priorities, and substitute policies. Again, the point is that integration of technology into education will require systemic changes to a greater or lesser degree. It can also be a catalyst or facilitator for changes such as project-based learning, teacher-led professional development, or school/community partnerships that may be desirable in their own right.

Technology Planning Checklist

The preceding discussion of systemic planning for technology can be summarized by a checklist of questions for planners:

1. Is there a leader who is able to communicate effectively with all stakeholders and influence the necessary policy-making and funding?
2. Is there a needs assessment that identifies key stakeholders, issues, and resources? Have representatives of all key stakeholders participated in the needs assessment?
3. Have stakeholders agreed on ways to evaluate progress in meeting needs and how to use that evaluation to change policy and practice?
4. Are stakeholders considering systemic changes that might be required or caused by new technologies, such as new roles and relationships for stakeholders, changes in how time and money are spent, and new ways of teaching and learning?
5. Has the planning team reached consensus on a vision of where the school or district needs to go and the actions necessary to get there? Can all members articulate the vision quickly and clearly?
6. Does the team have a strategic implementation plan that includes long-range goals and short-term objectives and that is based on the needs assessment, available resources, and research into appropriate technology and effective educational practice?
7. Do the resources include ongoing budgeting of money and time for both technology maintenance and professional development?
8. Is there an ongoing process to assess the implementation and make necessary changes? Can all stakeholders provide

feedback to this process and expect to be heard?

Similar checklists and planning aids are available in sources cited in the bibliography. See, for instance, the worksheets in Philip Brody's *Technology Planning and Management Handbook*, the questions for school board members in NSBA's *Leadership and Technology*, the planning chapter in David Moursund's *Effective Practice: Computer Technology in Education*, and the planning tools available online through the World Wide Web site of the South Central Regional Education Technology Consortium.

Chapter 3

Examples of Technology Plans

Numerous Oregon school districts have initiated or adopted comprehensive plans for the acquisition and use of technology. The examples of technology plans reported here include five school districts and the state's Department of Education.

Many districts have undertaken technology planning over the last decade, and sample plans are available from several sources. The NSBA's *Plans and Policies for Technology in Education* highlights planning materials produced by a large number of districts during the early 1990s, including excerpts and research instruments from Oregon's Salem/Keizer Public Schools. The Internet has enabled researchers and service centers to post technology plans and planning tools online.

The most comprehensive archive is currently the National Center for Technology Planning at Mississippi State University, which has for some years maintained a World Wide Web/Gopher archive of technology plans and supporting material, including several examples from schools in Oregon. Newer regional archives, such as those at the South Central Regional Technology Consortium and the Northwest Regional Educational Laboratory, are beginning to grow. Some educational units, such as the North Carolina Public Schools, have also made their planning documents available through their own web sites.

The six examples presented here were selected to illustrate a variety of approaches that different educational units (state, district, building) in Oregon have taken to develop plans in the "real world." Some plans were specifically recommended by administrators, others were selected from public archives. All illustrate the need for planners to work around constraints (some severe) as they try to integrate new technologies.

Bethel School District

Tim Goss, District Technology Coordinator

Bethel, a suburban school district north of Eugene, Oregon, used a distributed model of technology planning. In spring 1995, Technology Coordinator Tim Goss created planning templates and a sample plan that served as a model for the district's eight schools. The initial plans were revised in spring 1996.

"Each building had a pretty specific five-year budget going in, and they were told to divide it by five and spend accordingly," said Goss. "We have a certified person in each of our eight buildings who acts as the building

Curriculum Goals and Objectives
Malabon Elementary School, Bethel School District
1994-95

- All Malabon students will have daily access to a computer.
- All Malabon teachers will attend one half-day inservice on technology before the end of the current school year.
- Teachers who have no or little computer skills will acquire the beginning Macintosh skills that are presented in "Macintosh Basics" included on every new computer and also learn how to use a CD-ROM.
- Students in grades K-2 will use at least one curriculum-based program.
- Students in grades 3-5 will learn to access information from a CD-ROM disk such as Grolier's Encyclopedia or Electronic Arts' 3D Atlas.
- All students will learn a basic battery of safe computer practices, including turning the computer off and on, inserting floppy disks and CDs into the computer, opening and closing applications, and use of the mouse and keyboard.
- The staff will model appropriate and ethical behavior regarding copying rights.
- Release time will be provided to observe how teachers are currently using computers in the classroom.

1998-99

- All student records will be on-line by the end of this year, including CIM checkoff form.
- Students will develop their electronic portfolios, which will include samples of their work and the CIM checkoff for Levels 1 and 2.
- Intermediate level students will feel comfortable making their own QuickTime movies, gathering their graphics from a wide variety of resources.
- Primary-level students are starting to develop their own original stories incorporating graphics and sound.
- The homework hotline will be fully implemented.
- Staff will learn how to use new multiplatform computers.
- Staff will write self-evaluations on how well they met the goals of the Five-Year Plan and what further training they may need.

Source: http://www.bethel.k12.or.us/schools/malabon/malabonplan.html representative for technology. I worked with that group and each individual as well as with the building-technology committees in creating their plans."

According to Goss, the keys to getting all the buildings to complete plans were the interest and enthusiasm of the principals and the direction and support from the superintendent, who indicated that none of the technology money would be disbursed until plans were created.

The district provided guidance through its technology committee, which consists of teacher-technology representatives from each building, a high school principal, the district media specialist, the network coordinator, and Goss. "We meet once a month," said Goss, "and we did a half-day inservice to get the momentum going for the initial plan, and then a half day last spring to set the stage for the revisions."

This guided process was effective in getting all schools to develop technology plans. There is considerable variation among the Bethel plans, however. Some are brief, bulleted lists under the main headings of Curriculum Goals, Technology Additions, and Training Goals. Others offer rich narratives of the teachers' vision for 1999—students moving through an environment where they write, study, communicate, research, and present using a seamless network of digital devices. Specifying details of this vision was a burden on teachers in terms of time, according to Goss.

Tying technology to curriculum is a formidable challenge. Goss pointed out that the initial plans largely focused on "what to buy and who gets it," but the 1996 revisions placed greater emphasis on integration. In the accompanying excerpt below from Malabon Elementary School's plan, the objectives for the final year of the plan are tied to the stat Certificate of Initial Mastery (CIM), a key element in Oregon's outcomes-based reform effort.

Salem/Keizer Public Schools

Paul O'Driscoll, Director, Technology and Information Services

In the present fiscal climate, the single most difficult aspect of technology planning may be getting the plan funded. Salem/Keizer is a case in point. Technology and Information Services Director Paul O'Driscoll said his district is one of relatively few that have gone through the cycle of planning and revision and are operating under a second five-year plan. The original plan, prepared in 1991, was based on an extensive needs assessment (the 1991 survey instruments are available in NSBA's *Plans and Policies*). The plan had a high level of support and was partially funded ($5 million out of a proposed $27.6 million). The money was spent on the technology infrastructure, providing computers on teachers' desks, and establishing a wide-area network WAN and local LANs.

The 1995 update was not funded. Among other recommendations, it called for a 1:4 ratio of students to computer workstations, plus additional student access in labs and media centers, computers for teachers and staff, multimedia peripherals, internetworking, and interactive video. Individual schools were to prepare their own technology plans, with the building media center the focal point for teacher training and technology curriculum development.

The district's curriculum, instruction, and assessment services department was to develop curriculum standards for both teaching with and about technology. The main student-achievement goals to be addressed through technology were technology literacy, reading and effective communication, and critical thinking and problem-solving. Staff members were to be provided time to develop, pilot, and disseminate new curriculum models, as well as to develop their own technology skills.

O'Driscoll said the unfunded 1995 plan is still useful for the district. It guides him in budgeting his available resources, and it also provides guidance to individual schools attempting to implement technology programs.

Vision Statements

Salem/Keizer Public Schools Technology Plan

- The Technology Plan will be developed and implemented through an ongoing, interactive process that involves district staff, students, parents, and community members. The district's organizational structure and staffing will facilitate the efficient and cost-effective implementation of the plan. Funding will be provided to address equipment, staffing, professional development, and curriculum development needs. The Technology Plan should be updated annually.
- Students attending Salem/Keizer Public Schools will learn in a technology-enriched environment that will successfully prepare them for life and work in the 21st Century.
- Through extensive professional development opportunities and collaborative mentoring, Salem/Keizer Public Schools staff will become competent in the use of information technologies to provide enriched learning experiences for their students and to perform administrative tasks.
- Salem/Keizer Public Schools will be equipped with state-of-the art information technologies, linked by a high-speed network. The technical infrastructure and facilities will be fully capable of serving the educational and administrative requirements of the district.
- The technical infrastructure for Salem/Keizer Public Schools will facilitate the efficient and cost-effective performance of the district's management and business support functions through improved data processing and greater use of productivity tools.
- Salem/Keizer Public Schools will strengthen its ties with the community through greater sharing of information and communication facilitated by the use of technology.

Source: Paul O'Driscoll, Director, Technology and Information Services, Salem/Keizer Public Schools, P.O. Box 12024, Salem, OR 97309-1124.

Local initiative has its advantages; however, the down side of relying on building-level plans is that individual administrators among local schools may vary in their commitment to technology, less affluent communities usually provide less parent support, and some older buildings do not have electrical systems to support large numbers of computers.

Another issue is helping individual schools conform to standards so they can be guaranteed some level of technical support. O'Driscoll would like to have standards readily available, as on the World Wide Web, so they can be easily updated and all buildings can readily refer to the list of supported hardware and software. Concurring with those cited in preceding chapters, O'Driscoll believes integrating technology into education will require an annual allocation per student for technology, perhaps at the state level through lottery funds.

Lake Oswego School District

JoAnn Rachor, District Technology Coordinator

While the literature reviewed in this Bulletin suggests that high-level leadership is necessary for the ultimate success of a technology plan, grassroots activism has often been the initial agent of change. In the Lake Oswego, Oregon, School District, technology coordinators and the elementary library media specialists created a plan during the 1993-94 school year, with informal consultation from parents, administrators, and teachers. According to District Technology Coordinator JoAnn Rachor, the most important factor in creating their plan was "a willing community of learners—students, teachers, tech support staff, administrators, parents, business people—who are supportive of the use of technology in the district and a couple of pushers—people who would not let the plan die but kept pushing us to finish it."

The initial Lake Oswego plan had no budget for implementation. A technology bond allowed for implementation of some aspects of the plan, but Rachor said it is difficult to identify exactly what the cost has been to date. Technology in Lake Oswego has been funded through diverse sources, including the general budget, the bond, and donations through parent/teacher organizations and the district foundation. (Lake Oswego School District serves approximately 7,200 students and has a 1996-97 budget of $45,306,145.)

Rachor said piecemeal implementation also makes it hard to assess progress toward achieving the plan's objectives. Lake Oswego drew on the 1991 Salem-Keizer planning materials (mentioned earlier in this Bulletin) for a list of "problem areas" that it felt it shared with other districts. According to

Planning for the 21st Century
Lake Oswego School District

The Role of Technology

Our intent is to focus on the ways technology can support the instructional program in the school. Rather than concentrating on teaching technology, our emphasis is on the use of technological innovations as tools which help us complete the tasks we set before ourselves. However, more than any other innovation in recent times, we find the computer to be both a tool and a change agent. . . .

Shift toward applied use of information

The more technically competent students become in the use of technology, the less they require from the traditional emphasis in instruction, the acquisition of information. Increasingly critical to student success is a learning context in which students practice assessing, applying, and synthesizing the mass of information available literally at their fingertips . . . .

Shift from learning as a "school-based" activity

Our students are acquiring their own electronic pathways for exploring topics of personal interest, and those pathways are often beyond the borders of the traditional concept of "school." Motivated learners never have been restricted to the confines of a physical location (a school building) or a particular day or time for learning to occur. But access to resources and materials, experts, and mentors has been limited by time or place. Students working at home, or in a public library, or any location with a computer and modem can quickly access an incredible array of resources at any time of the day . . . .

Shift from static learning activities

As we restructure our curriculum with emerging CIM/CAM standards, increased emphasis is placed on using authentic learning tasks. Evaluating student outcomes with performance-based assessments more realistically approximates real-world expectations. When technology functions as a tool, its use is open-ended. The user evaluates the task in order to decide how best to use the range of options provided by the technology. The dynamic nature of the learning is greatly increased by the degree of individual control of the process.

Shift in the role of teachers

[I]n a period of rapid change, few teachers can claim to master the wide variety of technologies available today. The important issue becomes the degree to which a teacher is willing to be a learner along with the students. Adults who are willing to take on a "teacher-as-learner" role serve as extremely effective models by modeling strategies for acquiring knowledge, solving problems, and dealing with ambiguity.

Shift to viewing school facilities as a community resource

Technologically advanced schools view themselves as an extension of the parent, business, and neighborhood communities. These schools are the center for a variety of activities which are available throughout the year. Evening adult education classes, weekend workshops, summer classes for students, community access sites for Internet access, community bulletin board access, sites for interactive video presentations, and the ideas for using the technology resources will only continue to expand.

Source: http://www.nwrel.org/tech/regional/plans/lo/

Rachor, most areas have seen some progress, but much remains to be done:

- *Technology resources have been allocated without a clear purpose for their use*. The plan criticizes the policy of "giving a little to all," without regard for where the technology would be most appropriate.
- *Management of information is cumbersome*. The plan notes that the district needs to develop a common system for handling student records, health information, attendance, and so forth.
- *Communication is awkward*. According to Rachor, this is "getting better with our Wide Area Network, which has a node in almost every classroom and office districtwide, with Internet connectivity all around. We still have limited access to telephone lines in all schools."
- *Access to equipment and software is limited*. "Better, but there will always be a need for more," Rachor said.
- *Physical constraints of existing spaces provide many obstacles*. "We still have problems with electricity and with many classrooms having only four outlets, but we have managed to network all buildings."
- *Awareness/training/time*. "Teachers are handling larger class sizes and additional responsibilities as we continue to downsize. Some improvement, but it is slow in this area."
- *Technical support*. "We have four full-time teachers and three full-time technicians, but we have increased the amount of technology and the number of users faster than we have increased the support."

Another identified weakness was "a lack of clear vision of direction and role of technology." On this front, however, the district has made clear progress—it created the technology plan. And while Lake Oswego's grass-roots plan may have had haphazard implementation so far, there is an important change in the district in 1996-97. The superintendent has mandated updating the plan, and the voters approved a $5 million bond measure, of which JoAnn Rachor expects perhaps $300,000 to be devoted to technology.

Tigard-Tualatin School District

Mike Cullum, Technology Director

What sets apart the Tigard-Tualatin plan, titled "Future Paths," is that it concentrates exclusively on what students will learn instead of emphasizing network configurations or numbers of computers. It consists of performance standards for different grade levels for keyboarding, word processing, database, spreadsheet, graphics, telecommunications, technology basics, research, and multimedia presentations. For example, research standards for grade 2 call for students to "be able to use an on-line database to do a subject search on any topic." The middle and high school standards call for Boolean searches, with critical evaluation of the findings and adherence to copyright and citation practices.

In addition, the Tigard-Tualatin plan includes a matrix of specific activities for each grade, coded by subject areas addressed and "essential learnings" (see sidebar). For example, a kindergartner, learning language arts and functioning as a "communicator," will "use a computer and writing software to write name with capitals and lower case letters used appropriately." At the middle-school level, a language-arts student functioning mainly as a communicator would proofread and edit documents. Some of the activities, such as creating a web page at the middle-school level, span many disciplines and learning roles.

The plan was the creation of the thirty-four-member district technology committee, which includes teachers, parents, students, administrators,

SEVEN ESSENTIAL LEARNINGS FOR TECHNOLOGY TIGARD-TUALATIN SCHOOL DISTRICT

1. A person as *researcher* recognizes and values the breadth of information sources, browses those sources, differentiates and selectively chooses sources, and retrieves information data using all forms of media technology and telecommunications.
2. A person as *analyzer* is a critical thinker who reviews data from a variety of sources, analyzing, synthesizing, and evaluating data to transform them into useful information and knowledge to solve problems.
3. A person as a *creator/inventor* of knowledge constructs new meaning and knowledge by combining and synthesizing different types of information through technology, telecommunications, and computer modeling/simulations.
4. A person as a *communicator* creates, produces, and presents ideas and unique representations of thoughts through a variety of media by analyzing the task before him/her, the technologies available, and appropriately selecting and using the most effective tool(s)/ media for the purpose and audience.
5. A person as a *manager* discriminates among a variety of technologies and media to extend and expand his/her capabilities, and is effective in the accumulation, storage, and retrieval of relevant information in a timely manner.
6. A person as a *technician* develops sufficient technical skills to successfully install, set up, and use the technology and telecommunications tools in his/her daily life, work situations, and learning environments.
7. A person as a *responsible citizen* understands the ethical, cultural, environmental, and societal implications of technology and telecommunications, and develops a sense of stewardship and individual responsibility regarding his/her use of technology and telecommunications networks.

Source: Tigard-Tualatin school District 13137 SW Pacific Highway, Tigard, OR 97223.

and classified staff. Mike Cullum, district technology coordinator, said, "We make all decisions by consensus. Any member who objects to something strongly enough can stop the matter and get more discussion until we have worked out something that works for all."

The plan was reviewed by school-site councils, principals, and the associate superintendent before being published. In addition to the paper copy, the matrix of activities is provided to each school as a database on disk. The technology committee plans to revise the document each spring.

Cullum believes that planning focused on addressing learning outcomes rather than equipment lists is the logical approach for his district at this point. Tigard-Tualatin, which has an overall budget of about $56 million, has already put $3 million into local and wide-area networking and computers equivalent to a lab in each school and a computer in each classroom. (Individual schools decide on the actual deployment of the equipment.) An additional technology bond that passed in 1996 will allow continued development of the district's technology infrastructure.

However, those capital-improvement monies cannot be used for software or staff development—what Mike Cullum considers Tigard-Tualatin's greatest need. "Increasingly I am coming to believe that the real issue is freeing time for teachers to 'dink around' with the technology in an environment where they can apply it in creative ways without fear of failure," he said. "That is extremely difficult in the financial climate for schools in Oregon today."

Gresham-Barlow School District

Keith Eisele, Technology Coordinator

Of the districts examined here, Gresham-Barlow is the most emphatic about the economic imperative of educational technology. Drawing on government reports and historical parallels, the Gresham-Barlow planners argue that the use and application of computers and information resources are basic skills in their own right, ubiquitous in the workplace, and woefully absent in schools. The first goal of the Gresham-Barlow plan is "to provide a curriculum and learning environment in which students will learn the technological knowledge and skills necessary for emerging careers and post secondary education."

The plan illustrates its vision with numerous examples of how students and staff use technology. It proposes K-12 performance standards for technology, tied to the Oregon Certificates of Initial and Advanced Mastery. The plan also includes a list of Learning Processes that resembles the Essential

Resources
Gresham-Barlow School District

Achieving the goals and outlines described above will require considerable planning, collaboration, redesigned instruction, and staff development on the part of teachers and schools. Added resources and infrastructure support. . . will include the following categories:

1. [A]ccess to equipment, space, flexible/extended time and training [will be provided]for teachers and students.
2. Teachers must do each project themselves as their inservice training.
3. Teachers will require guided, compensated time. . . .
4. Students have a right to equal access and opportunity to learn. . . .
5. [A]dequate financial resources and accessibility to equipment and production labs must be assured.
6. [T]here are aspects of each outcome that can be undertaken now. . . .
7. The result of 10 years of self-discovery and planning for a career may increase student optimism, realism, meaning, and confidence.
8. A full-time technology repair person is needed.
9. A full-time district technology applications specialist is needed.
10. District and school staff need training to develop more partnerships.
11. Library-media centers will require greatly expanded resources.

Source: Gresham-Barlow School District
1331 NW Eastman Parkway, Gresham, OR 97030-3825

Learnings list from the Tigard-Tualatin District. A general list of needed resources ("access," "inservice training,") is followed by a matrix of specific technology requests tied to grade-level outcomes.

According to Technology Coordinator Keith Eisele, the document was the work of a technology advisory committee assembled at the request of district Superintendent James Carlisle. The committee included parents, teachers, and administrators. Eisele said that if he were to do it over again, he would include some student representatives. The planners researched other districts' technology plans and held "hundreds" of discussions over the course of a year, according to Eisele.

An important part of the process was "listening and trying to understand where people were coming from; understanding that there are lots of different stakeholders in the process with very legitimate points of view." An outside consultant was contracted to work on the project, and Eisele said this individual played an important role in helping the group come to consensus on difficult issues.

Gresham-Barlow serves 11,202 students, has a current budget of about $96 million, and estimates that implementing its technology plan would cost about $50 per student per year. Some would argue that supplying skilled workers, as described in the Gresham-Barlow technology plan, is not the ultimate aim of schooling. Indeed, Keith Eisele said, "The bottom line is how we will be changing the teaching and learning process for students with the new technology." However, the district's presentation of its case appears to have been persuasive to district voters. A $32 million bond measure was passed in September 1996, of which approximately $8 million was dedicated to technology.

State of Oregon

Tom Cook, Director, Oregon Public Education Network

The Oregon Goals 2000 Technology Proposal was conceived as a plan for planning. Rather than lists of equipment or specific skills that are typical of building or district plans, this statewide proposal concentrates on supporting and coordinating efforts around the state. It calls for development of a statewide systemic plan that involves a range of educational stakeholders and that will, in turn, support local planning efforts.

Tom Cook, now project manager of the Oregon Public Education Network (OPEN), oversaw development of the proposal as director of technology services at the Oregon State Department of Education. The proposal was written by a contractor, with information provided by Cook and researched by the contractor. Cook said the most difficult part of the planning process was simply finding all the information on the state's diverse technology efforts. The greatest aid was that everyone was willing to help.

The Goals 2000 Technology Proposal describes six requirements for a state technology plan:

- Collaborative planning between government, public and private entities at the state and local levels, and parent and community groups through a process of statewide grassroots outreach."
- Developing and implementing a statewide technology system to create a "coordinated telecommunications infrastructure."
- Improving student achievement, in line with the state's Certificates of Initial and Advanced Mastery.
- Professional development and technical assistance, recognizing "a profound need for continuing professional development for educators in the area of technology."
- Addressing all levels of need from the child to the community, through programs such as technology-aided, school-based integrated family services and basic literacy training for adults.

Introduction—Oregon Goals 2000 Technology Proposal State of Oregon Department of Education

Consistent with the systemic nature of school improvement in Oregon, this proposal embodies the vision of a system that merges instructional technology with administrative technology. Our vision is fiscally sound in its multipurpose use of currently existing telecommunications infrastructures. Ours is also an expansive vision in its recognition that as the teaching-learning process moves beyond the physical limits of the classroom, the full range of administrative practices and procedures must evolve to support student learning from pre-school through post-secondary education. Data collection, record-keeping, and other related information processing activities should support and inform rather than impede effective educational practice.

Source: http://www.nwrel.org/tech/regional/plans/or_goals2k/

- Program management and improvement, including budgeting and periodic review.

Cook said the state estimates it will cost between $280 and $860 million to bring technology to every classroom in the state, depending on level of implementation. Ironically, the positions of funder and fundee are in some sense reversed in this case. Cook said districts bring resources to the state plan, rather than the other way around, as they implement parts of the plan. The state's role is one of providing standards, coordination, and networking infrastructure. The Goals 2000 proposal sets out a vision of " a fully integrated cross-curricular technology system, developed through collaborative partnerships, that significantly impacts student learning." Impacting student learning, in this context, means supporting the Certificates of Mastery that are central to the state's school-reform effort.

The state's role also includes establishing and linking telecommunications networks. For instance, OPEN, which works through the state's education service district networks, offers another option for linking schools and community colleges to the Internet. The proposal also calls for the state to establish standards for hardware and networking technology and for professional development, and to aid in the development of administrative systems that will allow student records to be transferred promptly among schools and colleges.

Lessons of Implementation

Comparing any actual planning effort to the checklist in chapter 2, it is obvious that all the conditions for success are rarely met. The building, district, and state-level examples in this chapter provide suggestions about how to proceed under less-than-ideal circumstances. For example, there are a variety of ways to "get the ball rolling."

In Lake Oswego, technology coordinators spearheaded the initial planning themselves. Salem/Keizer undertook formal needs assessment, coordinated at the district level. Bethel put the responsibility on individual schools, but provided specific instruction (and financial contingencies) for participating in the planning effort. Generally plans do not begin with all stakeholders on board, and necessary participants may be summoned or enticed in various ways, depending on the community environment.

Another issue faced in the real world is how to allocate resources when a plan isn't funded. Salem/Keizer, Lake Oswego, Tigard-Tualatin, and the State of Oregon all chose to invest their limited resources initially into the network infrastructure. The rationale is that a well-designed network adds value to whatever technology is already installed, and the network will continue to provide this benefit as new equipment is brought online. On the other hand, new nonnetworked computers are of limited usefulness, and may be obsolete in the time it takes to network a district.

In general, unfunded or underfunded plans continue to serve as both targets and tools. They offer a target that districts can present to voters and funding agencies so that resource providers will know what they might buy with their bond measures or grants. At the same time, technology plans are a tool for short-term decision-making, helping to ensure that immediate opportunities to acquire equipment or human resources will contribute to long-term goals. In some cases, as in the Tigard-Tualatin curriculum guidelines, technology plans deal only with practices, not purchases, and can guide activities during various stages of a district's installation of hardware and software.

Conclusion

The idea that technology requires systemic planning is widely supported in the literature, as well as by the technology plans reviewed in the preceding chapter. Educational writers and technology planners, at least, are familiar with the complex relationships among such factors as technology, instruction, budgets, funding, school schedules, and professional development. Furthermore, the general stages of long-range planning are well known and widely publicized. There is no shortage of advice.

And yet, the very appreciation of the scope of the issue has to be intimidating for anyone in the school system, private sector, or general public who contemplates innovations in educational technology. If systemic change is necessary, but the resources to change an entire system are not available, why bother to attempt any change at all?

The answer to this dilemma, as offered by the Oregon schools whose plans are represented here, is that systemic change does not have to be immediate change. Sound technology plans do not just reveal what schools need, but what they need first, and what steps are necessary in what order to achieve progress. Put another way, technology plans reveal what we will do *without* at different levels of resources. In any case, the value of systemic technology planning should not be measured by the number of dollars allocated but by whether technology-related decisions, at whatever level of resources, are realistic and effective.

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