Excerpted from

Transforming Classroom Practice

Professional Development Strategies in Educational Technology

Edited by Arlene Borthwick and Melissa Pierson

This book provides an overview of professional development programs that have demonstrated long-term success through assessment of outcomes. The models described here explore approaches that expand teachers' knowledge, skill, and confidence in using technology tools in teaching and learning environments, with the focus on improving teaching and learning rather than on the technology use. Models discussed include in-house, peer-coaching, learning circles, action research, outside leaders and partners, networked learning communities, and working for systemic change.

Thirteen chapters cover a wide range of topics, including a history of professional development in educational technology and a grounding in the relevant literature; successful and cutting edge professional development models that discuss program planning, implementation, and assessments; and a discussion of lessons to be learned. The chapters are presented against a backdrop of selected relevant literature.

Introduction to Professional Development Strategies in Educational Technology

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Purpose, rationale, value

In an effort to assist those who are (or will be) responsible for planning, implementing, and/or assessing professional development in educational technology, this text provides an overview of professional development (PD) programs that have demonstrated long-term success through assessment of outcomes to provide recommendations for future effective professional development efforts. In the past, PD programs in educational technology have often focused on developing teacher competency in using specific hardware and software applications. By contrast, the models described in this text focus on approaches that expand teachers' knowledge, skill, and confidence in using technology tools in teaching and learning environments, with the focus on improving teaching and learning rather than on the technology use. Some teachers may be hesitant or even resistant to trying new instructional methods, yet the introduction of new technology tools in the classroom, accompanied by the appropriate professional development, may enable these teachers to implement student-centered constructivist approaches (Matzen & Edmunds, 2007). Although there is no one "right" approach to working with teachers, professional developers will increase their chances for success in developing a PD program for their local context when they base their work on a solid theoretical background of adult learning theory and organization development, along with an understanding of lessons learned from the practice of others through the years. This text aims to assist professional developers in just this way—through the guidance of fellow practicing professionals involved in innovative programs being implemented both nationally and internationally.

Content of the book

The book is divided into three sections: (1) a set of introductory chapters that provide a history of professional development in educational technology as well as a grounding in the literature on adult learning and organizational climate for effective professional development; (2) chapters on successful and cutting-edge professional development

models that describe program planning, implementation, and assessment; and (3) a closing chapter that highlights lessons to be learned by professional developers through reading this book. The professional development models included in the text represent long-term projects from which the authors could discuss observed outcomes (e.g., changes in learning environments) and recommendations for successful future implementation. The models involve a variety of information and communication technologies and the work of colleagues across the United States, Australia, and New Zealand.

Background chapters: History, adult learning, organization development

Chapters 1 through 3 frame the concept of educational technology professional development with an introduction (for novice professional developers) or an update (for experienced professional developers) to the history and research on professional development in educational technology, adult learning theory, and organizational context (school, district, and beyond) for successful professional development of teachers.

Models of professional development

Chapters 4 through 12 discuss selected professional development programs, grouped by general descriptive category: Working with In-House Leadership (chapters 4 through 6), Peer Coaching (chapter 7), Learning Circles (chapter 8), Action Research (chapter 9), Outside Leaders and Partners (chapter 10), Networked Learning Communities (chapter 11), and Systemic Change (chapter 12). Chapter authors chronicle the development of these programs along with significant outcomes. Although chapters are labeled as particular models, many of their approaches are hybrids involving more than one form of professional development (e.g., the approach described in chapter 11 includes online communities as well as on-site mentors).

Lessons learned: Charting your path to success

In the final chapter Pierson and Borthwick conclude the book by highlighting lessons learned from each chapter, reviewing common and disparate elements of the models discussed, and identifying themes that emerge throughout the chapters.

Special chapter features: Literature Essentials and Getting Started Resources

Each chapter in the "Models of Professional Development" section is presented against the backdrop of selected relevant literature in boxed features labeled ***Literature Essentials***. Rather than a comprehensive literature review, *Literature Essentials* situate each model in the collective experience and recommendations of researchers to enlighten your interpretation of the specific model and to inform the design and implementation of future professional development activities.

The intent of this text is that you will be interested, inspired, and intrigued to consider how elements of the models presented here might be applied to your own context. When you are ready to learn more about specific topics discussed in chapters 1 through 3, or one of the professional development models discussed in chapters 4 through 12, get started on your journey right away with the ***Getting Started Resources*** section at the end of each chapter. Chapter authors have identified and annotated resources helpful to successfully implementing professional development strategies akin to the methods discussed in their chapters.

Where should I start? PD models at a glance

You are encouraged to explore the background material and the PD models in any order as needed to support your growth as a professional developer. The Professional Development Models At a Glance table is intended to guide your exploration by outlining key characteristics of each model, including professional development activities, technologies, underlying framework, and assessment tools.

As you read, you will find that chapter authors share both knowledge and insights as they discuss key strategies, critical moments, challenges, and benefits of implementing professional development models in a specific context. Further informed by up-to-date literature on adult learning, organization development, and the historical underpinnings of professional development in educational technology, we hope that you will move forward with confidence as you plan PD activities to improve teaching and learning through the integration of information and communication technologies.

Audience for the book

The intended audience for this book is district and building-level professional developers, administrators, teacher-leaders, and technology committees responsible for planning professional development activities; and private, government, university, and agency consultants and researchers who design, implement, and assess the process and outcomes of professional development. The book will also be appropriate as a text in educational technology graduate programs or educational administration professional development courses and workshops.

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Professional Development (PD) Models At a Glance

Chapter	Title	Model	PD Activities
4	Designing and Sustaining Constructivist Learning Environments	In-house leadership	Sharing cases; workshops; information booklet; Web site; e-mail discussion list
5	Technology Apprentices, SWAT Teams, and Using Students for Professional Development	In-house leadership	Students as technology mentors for teachers and peers
6	Sustaining an Innovative Professional Development Initiative: Key characteristics to consider	In-house leadership	Peer-mentors; curriculum integration through understanding by design (UbD); year-round PD including graduate credit; mentor presentations at conferences
7	Peer Coaching and Technology Integration: Insights from three projects	Peer coaching	Peer coaching; inter-school peer mentoring; personal trainers
8	Digital Storytelling Promotes Technology Integration	Learning circles	Developing digital stories; ongoing mentoring
9	Teachers Doing IT For Themselves: Action research as professional development	Action research	Teaching mentoring; action research
10	Higher Education Institutions as Partners for Technology Professional Development	Working with outside leaders and partners	Intensive summer programs; collaborative curriculum design; mentoring
11	How Do We Support Teacher Learning Online and On-site?: Lessons learned from Washington's Networked Learning Community	Networked learning communities	Helping teachers establish a vision, situating learning in teachers' work, providing authentic audience for sharing
12	Ensuring Integration of Teacher Changes: What practices will make sure that professional development takes a hold?	Systemic change	Varied (as implemented in 50 grant-supported projects)

Technologies	Framework	Assessment Tools	Selected Lessons Learned
e-Portfolios	Constructivist learning environments; case based reasoning	Case stories, workshop feedback, e-Portfolio implementation	Long-term program with large impact possible through limited number of well-planned PD sessions
Laptop initiative for curriculum integration	Appreciative inquiry	Student and teacher focus groups	Stages of implementation led to paradigm shift of teacher-student roles
Variety of classroom tools; mentor e-mails and chats	Activity system	Journal entries, e-mail, online survey and structured interviews	Expect stages of PD program to include implementation "dip"
Internet resources	Job-embedded support	Peer coaching checklist matrix; survey and interviews; NCREL Learning with Technology tool; teacher feedback; review of teacher-designed materials	Peer coaching is successful when context includes well-designed materials, exemplary pedagogical strategies and receptive school culture
Multimedia; audio and videotape; online databases and other Internet resources; software applications such as PowerPoint, Photoshop or iMovie, and digital tools, such as digital camcorders or scanners	Situated cognition	Doug Johnson's Code 77 rubrics; TAGLIT teacher survey; individualized multimedia technology learning plan (IMTLP); summative sharing and reflection; direct observation, journals, and interviews	Teachers are successful when they learn technology through an authentic teaching application, supported through a learning community
Variety of information communication technologies (ICTs), especially eLearning	Reflective inquiry	Teacher self-study and research reports	Action research, supported by external mentoring, allows teachers to focus on own teaching practice beyond technology use
Web-based materials	School–university collaboration	Surveys, reports from mentors, observations, document analysis, formal external evaluation,	Partnerships with higher education afford resources that allow for success of K–12 PD
Online communication tool	Web-based learning communities	Teacher logs, case studies, interviews, lesson design, conference presentations	Success of online learning communities requires appropriate communication tools and structured learning activity, as well as connection with existing learning communities, peer experts, and initiatives
Varied (as implemented in 50 grant-supported projects)	Three I Model of Systems Change: Initiation, Implementation, Impact	Meta-analysis of 50 cases	Sustainability: PD without systems change is not effective

chapter 1

Professional Development in Educational Technology

What have we learned so far?

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abstract

THE INTRODUCTORY CHAPTER sets the stage with a brief overview of major initiatives and trends in professional development in educational technology during the first two decades of computers in schools. After a discussion of the importance of educational-technology professional development, this chapter will outline related theoretical models that have guided our understanding of, and provided a roadmap for, countless initiatives encouraging effective technology use. The chapter concludes with a review of the literature on strategies for increasing teacher adoption of technology in the learning environment.

When Irving Independent School District in Texas started its 1-to-1 laptop initiative in 2001, they needed to design technology training for 9,600 users over the next four years. The district's long-term goals included changing the very ways that teachers approached teaching and learning, so initial training targeted toward how to use the laptops in the classroom was crucial. Venturing into this new realm of learning opportunities dictated that teachers be prepared in new and different ways, including how to model best practice activities in the form of face-to-face interactions and online video clips. Much of the training focused on progressive concepts, such as learning to guide the students, as opposed to directing them; maintaining student interest in learning; and creating activities that seamlessly integrate technologies into the existing curriculum. The final results were transformative. Not only did the students learn more (Owen, Farsaii, Knezak, & Christensen, 2005), but students were reported to be more motivated and engaged. Teachers affirmed that the availability of technology became a benefit of their job and for many was a motivator for continued employment at this particular school district. Some teachers even observed that having such a technology-rich environment gave the Irving schools a hiring advantage with which other districts could not compete.

In districts with goals as progressive as those of Irving Independent School District, teachers attend workshops throughout the year designed to help improve their teaching. These workshops, interchangeably called *inservice education*, *teacher training*, *staff development*, *professional development*, or *human resource development* (National Staff Development Council [NSDC], 2006), may consist of single days of training that are often unrelated to each other. A common format is a guest speaker who dominates the entire day with a steady delivery of information. This single-day, one-size-fits-all model assumes that the audience of teachers use similar teaching methods with identical groups of students. As a result, there is very little change to overall teacher attitudes or skill levels with regard to the use of technology. Recently, though, this approach is morphing into models characterized more by personalized just-in-time instruction and ongoing support. Increasingly, teachers are encouraged to self-reflect and exchange ideas with one another concerning new teaching strategies. As we will see in this book, such an interactive approach is becoming one of the most effective tools for encouraging teacher change.

This chapter provides an introduction to educational-technology professional development, highlighting effective approaches that have been tested throughout computer technology's opening decades in schools. Though professional development of technology skills can be provided in a range of formats, such as demonstrations or hands-on workshops, it is important to avoid assuming that rows of computers are the most important ingredient. In fact, a room that is designed for participants to talk, share techniques, and collaboratively pose and answer questions about their technology-enriched lessons can be of far greater value. Major contributing theoretical frameworks, such as teacher learning, dissemination of innovation, and change theory, will be discussed as key ingredients to creating sound and effective strategies for increasing teacher adoption of technology in the learning environment.

Why is professional development vital to effective technology use?

Investing in long-term professional development goals such as those of the Irving Independent School District means relying on the professionalism and expertise of each teacher, not only in the areas of content and pedagogy, but also in the appropriate use of technology (Mishra & Koehler, 2006; Pierson, 2001). To positively affect teacher action in the classroom, teachers must be convinced that these new instructional technologies (IT) will actually lead to increased student learning. Once a teacher has created a personal goal of using technology, learning new technical skills is one thing, but learning how to effectively teach with IT is something entirely different.

The National Staff Development Council (NSDC) recommends that 25% of professional development time be devoted to learning and collaborating with colleagues (NSDC, 2006). This recommendation is evident in some countries where teachers are required to spend only 15 hours per week in the classroom and the rest of the time planning, meeting with colleagues, continuing their education, contacting parents, and working with students (Darling-Hammond, 1998). Asian countries such as Japan and Korea are reported to allocate a much larger amount of a teacher's schedule to professional development than their American counterparts. In these countries, approximately 60 days a year are set aside for new teachers to spend working with other teachers, parents, and students in a nonteaching setting (Bond, 1998). New teachers in American public schools, on the other hand, are often turned loose in their classrooms, only to be heard from again on the day they quit (Brown, 2003).

What many people outside the educational community fail to realize is that the single greatest impact on improved student achievement is increased teacher education. The qualifications of the teacher constitute 44% of the impact on student learning (NSDC, 2006). Joellen Killion, Director of Special Projects for the NSDC, states that the ultimate goal of any educational professional development is to improve student achievement, which can be accomplished in three ways: (1) increasing teacher content knowledge, (2) changing teachers' attitudes about their content areas, and (3) expanding the teacher's repertoire of instructional practices (Killion & NSDC, 2002). Clearly, then, IT professional development would overlay the goal—increasing the meaningful use of technology—with both content and pedagogy.

Not only does technology offer a variety of instructional options to teachers, it additionally motivates students who are accustomed to electronic devices in their everyday lives. And yet, one study (Sparks, 2006) reported that only 7% of schools have teachers who are technologically advanced enough to effectively integrate technology into their lessons. Lawless and Pellegrino (2007) believe it is unclear that students will "have access to teachers who know how to use that technology well to support 21st-century learning and teaching" (p. 578). This works against a long-held Vygotskian belief that teachers need to be aware of sociocultural influences on their students to maximize each student's understanding of the curriculum and the world around them (Vygotsky & Cole, 1978). This same study found that 36% of schools provide no professional development for

technology and another 29% provide only 1–14 hours a year. It labeled teacher development as the "biggest technology challenge" facing schools. Even William Bennett, the former Secretary of Education, who stated that there was no significant evidence that most uses of computers significantly improve learning, conceded that "[when] teachers aren't trained to teach differently with the help of [computer] equipment, all too often they end up forfeiting its latent benefit and allowing students to play games or roam the Web" (Bennett, 1999).

If the primary purpose of professional development is to improve the learning outcomes of students, then the first goal of any professional development model should be to change the way each teacher actually teaches (Guskey, 2002). Initial tangible differences in the ways teachers conduct their classes as a result of a workshop might entail using a computer with a projector to demonstrate a science simulation, or it might include guiding students to do research independently at the Library of Congress's Web site. A logical next goal is that teachers take time to analyze the overall effect of any new approach on student learning, such as by gathering frequent feedback directly from students. Teachers too often abandon a new approach because they have not taken the time to examine the end results on students. Even if student learning has increased, teachers still may find it difficult to make changes in their teaching permanent.

Studies have suggested that the effects of good professional development alone are reason enough to provide training whenever possible. One study showed that schools in which teachers had technology training and used computers to teach higher-order skills also enjoyed lower student absenteeism and higher teacher morale (Schacter, 1999). The study also found that students of teachers who had received any kind of staff development in computer technology during the past five years outperformed students whose teachers had no educational technology training. In fact, eighth graders whose teachers had technology training were found to be one-third of a grade level higher than those whose teachers lacked this training.

Theoretical support for educational technology professional development

During the first two decades of rapid growth of IT use by classroom teachers, a number of theoretical models emerged to describe developmental levels of teachers' progress in learning to teach with technology over a period of time, including changes in instructional practices, attitudes, concerns, and adoption of innovations. These models have guided our understanding of, and provided a roadmap for, countless initiatives encouraging effective technology use. Primary in all of these models is the acknowledgement that change is a process that takes time and requires constant support in order for the individuals attempting to change to be successful.

Stages of concern

Starting in 1981, Apple Inc. created opportunities for educators to observe and develop their own methods of teaching to take advantage of the many benefits that technology offers. During its 10-year research project, the Apple Classrooms of Tomorrow (ACOT) studied the changes in instructional beliefs and practices of elementary and secondary teachers and their students due to the infusion of an exceptional amount of technology. A primary outcome that emerged over the multiple-year study was a set of five *Stages of Concern* of individual teachers as they grew comfortable with using technology (Sandholtz, Ringstaff, & Dwyer, 1997).

The first stage, *Entry*, addresses the uncertainty teachers may feel about their own ability to use the new technology in their classrooms. Professional developers should be aware of teacher confidence levels as well as getting teachers to focus on careful planning. The next stage, *Adoption*, describes skills and strategies for effectively coping with challenges that arise during a lesson. During the *Adaptation* stage, teachers began making the technology work for them, getting past issues of teaching the technology and back to teaching content. Teachers also reported that administrative duties, such as record keeping and test creation, were made easier and less time-consuming by use of the technology. *Appropriation* is the stage at which technology is used effortlessly as a tool for teaching. If these developmental stages are achieved, the teacher can progress into the *Invention* stage, in which a new learning environment is developed as a context for using technological resources. Outcomes from the research showed that technology can positively impact the classroom climate and the capabilities of students (Sandholtz et al., 1997). In addition to outlining the various phases through which teachers progress, Sandholtz, Ringstaff, and Dwyer outline the types of support teachers require during these phases, including emotional support (Entry), with the later addition of technical assistance (during Adoption), opportunities for instructional sharing (during Adaptation), and the option of team teaching (during Appropriation and Invention). Apple's success also inspired other technology companies to create their own educator development projects, such as Intel's *Teach to the Future* and IBM's *Reinventing Education*, although not until years later.

Concerns-based adoption model (CBAM)

The Concerns-Based Adoption Model (CBAM) (Hall & Hord, 1987) has guided professional developers by describing *Stages of Concerns* and *Levels of Use* of teachers engaged in a process of change related to technology. Professional developers who understand where each teacher is in the change process are more likely to be successful than those who plunge headlong into the content of a session with little or no attempt to get to know each participant. Listening to the types of questions being asked and the ways each teacher is using technology allows the professional developer to accurately understand which stage each teacher is in. In general, teachers at the beginning of a change process ask more self-oriented questions, about how a new technology will help them personally

(*Awareness*, *Informational*, *Personal*). Once they have developed a base of initial confidence, teachers' questions become more task-oriented, related to how they use the tool and why they are having particular challenges (*Management*, *Consequence*). And, toward the end of the process, teachers tend to alter their perspective to look toward their work with others and the larger impact of the use of the technology on students (*Collaboration*, *Refocusing*).

Together with teacher questions, the CBAM Levels of Use taxonomy describes how teachers use technology tools in different ways as they move through a change process, which has specific implications for the individualization of professional development. Over time, teachers work to implement what they have learned in authentic classroom settings and must continue to have access to and guidance from a professional trained in effective technology use. Beginning users (*Non-Use*, *Orientation*, *Preparation*) require information and specific plans to use the technology. As they develop more skill and confidence, tool usage becomes the norm (*Mechanical*, *Routine*), meaning professional developers may need to combat teachers' beliefs that they have already learned all there is to learn. At latter stages of the process (*Refinement*, *Integration*, *Renewal*), teachers again open up to considering further changes in their own practice. Professional developers must monitor the Stages of Concern and Levels of Use of their participants over the course of several months or years.

Diffusion of innovations

From Everett Rogers (2003), professional developers have learned that the adoption of innovations is dependent on several interrelated models of change. Individual teachers themselves, as adopters of new technology innovations, fall into predictable categories that describe their comfort with and level of adventurousness toward the uncertainty of newness. *Innovators* are at the cutting edge, latching onto new instructional technologies first. The majority of teachers will fall into one of three middle categories: *Early Adopters*, *Early Majority*, and *Late Majority*. Bringing up the rear are the *Laggards*, who tend to resist new innovations and frequently pose the largest challenge to professional developers. The decision process that an individual teacher goes through to adopt an innovation also follows a developmental pattern through the stages of *Knowledge*, *Persuasion*, *Decision*, *Implementation*, and *Confirmation*. And each innovation itself possesses attributes that make it more or less desirable to an adopter: *Relative Advantage*, *Compatibility*, *Complexity*, *Trialability*, and *Observability*. Those who are conducting professional development sessions are often placed in the role of "Change Agent," a role described by Rogers as one that changes or shifts during the diffusion process, a role that eventually leads to working oneself out of a job as others become more proficient.

Four-stage professional renewal cycle

Kansas State University faculty members Gerald Bailey and Dan Lumley (Bailey & Lumley, 1997) revisited this model, initially developed by Joyce and Showers (1988), which is designed to describe how educators interact with new educational materials and strategies. At the beginning of the cycle, participants interact and share ideas about the new material (*Information*). The next stage gives an opportunity for the group to see the new teaching approach in action via an actual lesson or possibly a video recording (*Demonstration*). Time is then devoted to practicing this new approach so that each participant gets a chance to experience it firsthand (*Practice*). After the practice, it is important for the participants to come back together to share their experiences. The final stage is to pair each participant with a coach who is well trained in the new teaching approach. It is at this stage that the participant works out specific details that apply to his or her teaching environment (*Feedback*).

Knowledge, attitude, skill, aspiration, and behavior (KASAB)

A common model of planning for professional development is *Knowledge*, *Attitude*, *Skill*, *Aspiration*, and *Behavior*, or KASAB (Killion & NSDC, 2002). The KASAB model helps professional developers understand how teachers move beyond merely creating a path to achieving a specified goal. In this model, professional developers focus on having teachers learn more about a topic (*Knowledge)*. Once the teachers experience the possibilities, they are motivated (*Attitude*) to learn more about the topic. After taking time to build their skills (*Skills*), the teachers are further motivated to develop lessons themselves using their newly acquired skills (*Aspiration*). The resulting behavior is that teachers will change how they teach (*Behavior*).

New consensus model: Individual and collaborative inquiry

In 2002, one Minnesota school established a project that required long-term participation from its teachers. Small groups of teachers collaboratively investigated pedagogical and content issues to bring about a change in teaching practice (Hughes, Kerr, & Ooms, 2005). This project was based on the new consensus model of Hawley and Valli (1999) in which teachers were asked to choose their own topic of study and collaborate in small groups. Teachers then took part in a careful self-reflection, taking stock of their own beliefs and specific approaches to teaching. Detailed discussions as a group included considering alternatives to current practices and possible effects of each change. Finally, the new practice was integrated into a lesson plan and taught in a classroom. Final discussions with the group about the effect of this new lesson helped to fine-tune the lesson for use in subsequent classes.

Professional development frameworks

Through the late 1990s, educational technology workshops could be categorized by a framework of four types of professional development activities (Bailey & Lumley, 1997). The first of these four, *Administrative Productivity*, has gotten a lot of attention recently, especially due to the demands of the United States of America No Child Left Behind (NCLB) legislation, which requires large amounts of student data to be collected and analyzed to guide the curriculum. Workshops in this category include training in software designed to increase the everyday functioning of the school, including automated attendance, record keeping, and maintaining a Web site. The second of these four types of workshops is referred to as *Teaching and Learning*. This is professional development designed specifically to help the teacher with the effective application and integration of technology resources into existing curriculum. The third type of workshop can be labeled *Curricular Production–Tools*. Training in this category mainly includes the prepackaged software programs that are sold to schools as a conveniently organized method of teaching, tracking, and reporting student progress. Some of these are better known as Integrated Learning Systems (ILS), which consist of a wide variety of bundled activities and corresponding testing and remediation alternatives. Workshops on production tools have seen a resurgence recently, once again due to the recent NCLB legislation. Finally, the fourth type of workshop deals with the concept of *School Restructuring*. With the advent of the digital age, schools are finding they need to reform their practices to address the overall effects technology is having on our society. As a method of reform, it is important to start a dialogue with teachers, students, and community members about how schools can best meet these new challenges. NCLB has had an effect here, also, by discouraging this conversation. NCLB's focus on frequent and high-stakes assessment is challenged by opponents who believe over-reliance on high-stakes testing may lead to inaccurate conclusions and be potentially harmful to teaching–learning environments. However, as we have seen, there are school district plans, such as Irving Independent School District's constructivist model, that embrace progressive approaches to professional development and school reform.

As the field of educational technology professional development has evolved, Judy Harris, a former teacher and now a professor at the College of William and Mary, has suggested a more sophisticated framework focusing on teacher action and context (2007). She contends that there are five general types of professional development models:

- Group training, which involves demonstrations or instructor-led hands-on activities;
- Individualized learning, or independent exploration;
- Collaborative observation and analysis, a more involved model that may involve school visits, mentoring, peer coaching, and critical friends;
- Inquiry/Action research, requiring systematic data collection and analysis; and
- Collaborative development/improvement, which takes the form of group projects or problem-solving.

Lawless and Pellegrino (2007) largely concur that high-quality professional development must "[be] longer in duration (contact hours plus follow-up), provide access to new technologies for teaching and learning, actively engage teachers in meaningful and relevant activities for their individual contexts, promote peer collaboration and community building, and have a clearly articulated and a common vision for student achievement" (p. 579). Harris (2007) suggests that although professional development can vary by purpose, objectives, content, grade levels, pedagogies, models, and assessment, effective sessions are all: (1) conducted in school settings; (2) linked to school-wide change efforts; (3) teacher-planned and teacher-assisted; (4) differentiated learning opportunities; (5) focused around teacher-chosen goals and activities; (6) exhibit a pattern of demonstration/trial/feedback; (7) concrete; (8) ongoing over time; and (9) characterized by ongoing assistance and support on-call. However, because factors such as availability of technology, school climate, or participants' experience can vary, professional developers must match the type of professional development to teachers' learning preferences, the goals of any professional development, and the specific context. This matching requires professional developers to select, combine, and sequence goals and models to fit the specific professional development situation.

Strategies for increasing teacher adoption of technology

On a basic level, the field of education has reached a consensus about what is considered best practice regarding educational technology professional development. In short, professional development will result in the adoption of the desired skill or practice when active participants are the focus of standards-based, integrated content that is continually assessed for effectiveness on many measures.

Focus on participants

Professional developer Angela Peery (2004) compiled a list of the qualities used by teacher-participants to describe an effective professional development experience. The descriptors predominantly focused on treating teachers as professionals who are fully able to make effective decisions about their classroom lessons. Words such as *congenial*, *no pressure*, *validation*, *trust*, *informative*, *flexible*, and *clear purpose* all describe workshops that respect teachers in their roles of decision-maker and caretaker.

Workshops held by RAND/CTI (Glennon & Melmed, 2000) contributed three additional insights that increased effectiveness of professional development. These include providing: (1) adequate time for teachers to acquire skills and plan the school's programs and activities, (2) assistance that is keyed to the needs of the teachers and administrators at times they need it, and (3) a clear vision concerning the purposes and the educational goals that guide the program of the school and classroom.

As studies have shown, a high level of anxiety about computers detracts from the ability to learn skills, and even creates a resistance to learning. In addition, those who are confident of their own ability with computers have been shown to persist at computer-related tasks longer than those who are not (Sam, Othman, & Nordin, 2005). Making participants comfortable—such as by offering food and drink, interacting with the participants, and acknowledging the different needs and skills of each attendee—is an effective initial strategy.

Teachers rarely have the opportunity to come together and converse about their teaching (Vanatta, Banister, Fischer, Messenheimer, & Ross, 2005). When teachers are allowed to come together and share ideas, participants often find so much in common with one another that they readily find answers to problems with which they have struggled. Collaboration can happen on a large scale, such as by having an entire group of teachers travel to a conference together (Rhine & Bailey, 2005), which can introduce an immediate level of bonding that strengthens a group's ability to exchange ideas and critique new approaches, as well as serves as the foundation for future change. However, smaller-scale collaborative techniques can be just as powerful. Reading and discussing a common book (Joyce & Showers, 2002), participating in a teacher support network or community of practice (Killion, 2007; Niesz, 2007), or frequenting social networking sites for educators (e.g., eduwikius.wikispaces.com or www.infinitethinking.org) can allow teachers the time for shared experiences and development. The ability of a group to bond and length of the program were also found to be critical to the long-term success of any training program (McPherson, Wizer, & Pierrel, 2006). In order to help preserve bonding between participants over time, online discussion boards and e-mail discussion lists can be established.

Broad participation

To be fully effective, the exchange of ideas should take place not only among teachers, but also with administrators and other specialists (Fullan, 1982). Technology coordinators and computer-lab teachers play an important role in sharing ideas with general-education teachers about enhancing the curriculum with technology. When professional development is being planned and carried out, or even when a subject-area curriculum is being mapped out, having a technology specialist on hand to answer questions is invaluable. Without this integration of school personnel, curriculum designers often do not take the crucial step of adding specific technology-enhanced activities. The use of technology may be intended, but there are no specific software or activity needs identified to help achieve the desired learning outcomes.

Administrators can also participate by evaluating teachers specifically on how well they integrate technology into lessons. Too often, when a principal or other teacher evaluator sees a computer on and students busy using it, they assume legitimate curricular goals are being met. Of course this is not always the case. With the proper training and awareness of teacher technology use standards (e.g., NETS•T, International Society for Technology in Education [ISTE], 2008), teacher evaluators can more easily spot appropriate and effective uses of technology. By devoting a section of the evaluation process

to technology as a teaching tool, evaluators can motivate teachers to integrate new skills they have learned in workshops. As a follow-up activity with the teacher, the well-trained evaluator can then make suggestions about how to improve the lesson.

Isolated versus integrated teaching of technical skills

One of the ongoing debates of technology-related professional development planning is whether helping to develop a wide array of computer skills among teachers will actually lead to increased usage of technology in the classroom. One approach focuses on teaching all of the capabilities of a software program, regardless of whether those features will ever get used. Another approach argues that, after receiving an overview of the software, participants can explore the features of the software as needed. A third approach is to wait for the group to convene and decide according to their needs. That would require the planners of the sessions to tailor staff development to individual teachers or small groups of teachers rather than provide a one-size-fits-all generic model (Sparks, 1998). Darling-Hammond (1998) explains that choosing the appropriate foundation-building skills is integral to a good start. Without a basic foundation, participants may find themselves overwhelmed. Educator Mike Schmoker promotes a slightly different approach. He believes that participants are just as able to learn, if not more so, if basic skills are unveiled during times of challenging activities (Schmoker, 1999). He also points out that low-performing participants stand to gain the most from approaches that incorporate basic skills into complex, higher-order-thinking skills.

There are two common scenarios in which training takes place: demonstration by a presenter or hands-on training. One assumption is that workshops in which participants are led through a step-by-step process in a hands-on environment will result in a very successful start. However, when people are simply asked to follow directions, they are doing very little to internalize the learning experience. Relatively little cognitive processing goes on when a person is just following directions. Professional development support must include giving teachers time to experiment, permission to change the way they do things, and the opportunity to make mistakes along the way (Sparks, 1998). In the act of listening to directions, the learner may never feel truly involved, ask questions, or even become curious about the process. On the other hand, if the training requires the participants to watch a demonstration first, followed immediately with hands-on time, then the responsibility and desire to complete the task is turned back to the participant (Darling-Hammond, 1998). Perhaps even the anguish of being frustrated lends itself to the learning process because it draws the learner into the learning process in a much more active way. In addition, it can be argued that the participants learn more because they know they have to rely on themselves to complete the task and not just follow the rote, verbal directions from the trainer.

Assessment of effectiveness

As we enter the 21st century, research describes the most effective professional development, leading to the most lasting results, as possessing a common set of qualities: (1) long term participation; (2) focus on specific content and/or strategies rather than being general (Fishman, Marx, Best, & Tal, 2003); (3) collaborative participation, as in communities of practice (Borko, 2004; Grossman, Wineburg, & Woolworth, 2001; Little, 2002); (4) coherence; and (5) involving active learning (Desimone, Porter, Garet, Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001).

Guskey (2000) recommends further that evaluation of professional development examine five areas: (1) participants' reactions, (2) participants' learning, (3) organization support and change, (4) participants' use of new knowledge and skills, and (5) student learning outcomes. The major challenge that remains is measuring the effectiveness of educational technology professional development on teaching and student learning. Despite countless professional development efforts that have been standards-based and aimed at teachers' developmental levels, the inconsistent mix of evaluation methods makes it nearly impossible to attribute any positive (or negative) effects to any specific professional development experience, due either to a lack of a comparison group or because professional development is often instituted as part of a wider reform strategy (Snow-Renner & Lauer, 2005; Spillane, 1999). Additionally, challenges in determining effectiveness lie with how greatly varied the actual quality and makeup of professional development opportunities are, as well as with the use of measurement tools that are not aligned with the specific goals of the professional development (Snow-Renner & Lauer, 2005). Lawless and Pellegrino (2007) provide recommendations for future research on educational technology professional development, highlighting the need to focus interrelated systems to assure that outcomes were the direct result of professional development as opposed to other variables, and further noting the lack of experimental studies and the lack of data collected from students.

Ultimately, although research generally shows that students learn more and are more actively engaged when teachers learn more and are more actively engaged, and despite the addition, and even integration, of instructional technologies, basic instructional practices persist (Mitchum, Wells, & Wells, 2003). A key to this inability to convince teachers to significantly change the way they teach by incorporating modern technologies is the fact that the field of educational technology research lacks proof that using technology leads to increased achievement (Kerr, 1991). In the climate of accountability present in the early 21st century, this absence of causal effects of technology on achievement after considerable technology expenditures—despite myriad isolated positive descriptive studies—makes a continued focus on professional development for educational technology a challenge for districts. Many administrators assume that once their teachers can send an e-mail or make an electronic presentation, they have arrived as a technology-using district and no longer require professional development. There is thus a continued need for accurate assessment of teacher needs and teacher growth as it relates to technology use.

Focus on standards

During the early part of the 21st century, professional development efforts, along with most education initiatives, were significantly influenced by the development of, and almost universal adherence to, standards in all content and professional areas. The International Society for Technology in Education (ISTE) has become the leading professional organization for technology-using educators. Starting in 1998, ISTE developed the now widely accepted National Educational Technology Standards not only for students, but also for teachers and administrators. Known, respectively, as NETS•S, NETS•T, and NETS•A, these standards are written with the goal of improving teaching and learning by advancing the effective use of technology in education.

The *Framework for 21st Century Learning* outlines the competencies that need to be developed to enable today's students to be digitally literate, inventive thinkers, effective communicators, and highly productive (Partnership for 21st Century Skills, 2008). If teachers are not introduced to these competencies and related standards during professional development workshops, fundamental changes, such as the ones happening in Irving Independent School District, will not become as commonplace as they need to be. The Partnership for 21st Century Skills remind us that we live in a knowledge-based, global society that requires shifts in school policy and practices.

Conclusion

Many veteran teachers can recall a time in their careers when a specific type of technology was introduced at their schools, only to be given up within a few years for the next innovation. Whether the technology was too complex, was never fully adopted by faculty, or was replaced by newer technology, the whole process may have created negative feelings toward technology as a whole. Stories like this are a challenge for professional developers to overcome. Teachers may recall giving up a great deal of their personal time to learn and integrate a promising new technology only to find that it did not deliver what was promised.

As educators consider new models of professional development such as those presented in this book, and as they identify goals and strategies to achieve an ideal balance of individualization and group participation, they will need to actively study the effects of professional development on teaching and learning. Certainly, the field of education has come a great distance in understanding the range of best practices regarding educational technology professional development. However, consensus on a research agenda in this field will allow us to seek to understand the role of the individual and context in the race to develop 21st-century teachers who guide and shape student learning.

GETTING STARTED RESOURCES

ACOT. (2007). *Apple classroom of tomorrow.* Retrieved October, 2007, from www.apple.com/education/k12/leadership/acot/

This is the home for the groundbreaking 10-year research and development project sponsored by Apple Inc. A library archive provides easy access to related project reports and articles.

ALTEC. (2003). *Exhibit: ALTEC learning interchange.* Retrieved October, 2007, from http://ali.apple.com/ali_sites/hpli/exhibits/1000097/Introduction.html

By all accounts, the PT^3 program was the single largest impetus for the growth of technology-related professional development. This site is the best remaining archive of the funding model, notable and enduring projects, and related resources and assessment tools.

Lamb, A., & Johnson, L. (2007). *Teacher tap: Professional development resources for educators & librarians.* Retrieved October, 2007, from http://eduscapes.com/tap/

Providing easy access to practical, online resources and activities, the Teacher Tap is a free professional-development resource that helps educators and librarians address common questions about the use of technology in teaching and learning.

NSDC. (2007). *Welcome to NSDC.* Retrieved October, 2007, from www.nsdc.org

The National Staff Development Council (NSDC) has the stated purpose of "ensuring that every educator engages in effective professional learning every day so every student achieves." The site highlights projects, publications, conference information, online communities, and the "Professional Development IQ Test" that assists district leaders in exploring the relationship between professional development and student learning.

Partnership for 21st Century Skills. (2008). Retrieved April 6, 2008 from www.21stcenturyskills.org

Informed school and district leaders can use the *Framework for 21st Century Learning* to redefine what it means to be educated. The framework integrates key student outcomes of learning, including core subjects; life and career skills; learning and innovation skills; and information, media and technology skills with necessary support systems of learning environments; professional development; curriculum and instruction; and standards and assessment. The framework encourages educators at all levels to consider the use of 21st century skills to help facilitate change in education.

Transforming Classroom Practice

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