Web-based Training for Technology Skills Acquisition:

Professional Development for the Digital Age

A Review of Literature
by
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Abstract

As school districts seek cost-effective methods for supporting teachers in their efforts to develop the technology skills, many are examining the use of technology-mediated professional development (TMPD) as an alternative to traditional face-to-face delivery system. The option of self-paced, self-directed, anytime/anywhere learning offered by Web-based training has an appeal for busy educators who seek to control the time, place, content, and duration of their learning. The goal, therefore, is to determine if technology-mediated professional development, whether it targets technology skills or curriculum-related issues, will actually alter a teacher’s knowledge or practice. Using recent professional literature, the researcher examined the historical context that has led to the increasing use of E-learning, the factors that inform classroom technology integration, the theories associated with technology skills acquisition by teachers, and the implications for professional development in the digital world. She concludes that there is currently insufficient evidence that Web-based training (WBT) is an effective method meeting district technology integration goals and offers suggestions for future study.
# Table of Contents

- **Introduction**
- **Topic Overview and Purpose**
- **Organization of the Review**
- **Interest, Significance, and Rationale for the Critical Analysis**
- **Review of Literature**
  - *An Overview of Technology-Delivered Instruction: What’s on the Shelf?*
    - The E-learning aisle.
    - WBT: An old product with new packaging.
    - The interest in E-learning products.
    - Considerations related to TMPD.
  - *Changing America’s Classrooms: Who Is Pushing the Cart?*
    - Cart-pushers: The national scene.
    - Cart-pushers: The state and district scene.
    - Cart-pushers: Teachers seeking technology integration.
  - *Defining Technology Integration*
    - Measuring technology integration.
    - Supporting technology integration.
    - Technology integration as change.
  - *Professional Development in the Digital Age*
    - Technology-mediated professional development.
    - Factors that influence learning in an online setting.
    - Computer self-efficacy.
    - Measuring computer acceptance.
    - Adult learners.
- **Discussion**
- **Summary and Interpretations**
- **Recommendations**
- **References**
Web-based Training in Technology:
Professional Development for the Digital Age

Introduction

In recent years, increasing demands upon K-12 educators to integrate technology into their professional practices have sent teachers who were educated prior to the recent technology revolution scrambling to acquire new skills sets (McKenzie, 1999). The No Child Left Behind (NCLB) Act of 2001 quantified these demands by delineating the need for students to have acquired basic technology literacy by the time they leave eighth grade (U.S. Department of Education, 2002). However, it is doubtful that students will acquire these skills on their own. Responsibility for achieving these goals appears to rest on the shoulders of the regular classroom teacher, who is expected to provide a technology-rich learning environment where 21st century skills can be acquired and practiced (Ivers, 2003).

Topic Overview and Purpose

In their attempts to assist teachers in providing a technology-rich learning environment for their students, school districts focused their early efforts on hardware and wiring, only to discover that technology integration does not magically occur when computers appear in classrooms (Cuban, Kirkpatrick, & Peck, 2001). The Enhancing Education Through Technology (EETT) block-grant program provided by Title II, Section D, of the No Child Left Behind Act of 2001 aimed to rectify this situation by requiring a 25% local set-aside for professional development supporting teacher integration of technology into classroom practices (U.S. Department of Education, 2003). Acknowledged as the main source of federal funding for technology support in schools,
the EETT grant has unfortunately been the target of incremental reductions over the past four years from nearly $700 million in 2004 to $269.5 million in 2008 (Nagel, 2008). As a result, technology programs across the nation are being required to compete for the federal and district dollars that are a part of a dwindling pool of resources and, effectively, to do more with less.

As a way to meet teachers’ specific technology needs and as a cost-cutting measure, many school districts are considering the use of computer-based delivery of professional development as an alternative to the traditional face-to-face delivery systems (Butler, 2006). One type of technology-mediated professional development is termed Web-based training, which has earned attention because of its comparative low-cost and its ability to provide flexibility of learning times and locations (Joiner, 2002). This interest is despite the fact that little research exists to measure the actual effectiveness of technology-mediated programs when they are used to provide staff development.

Consequently, a need exists to determine if these Web-based training programs are actually effective in changing or enhancing the classroom practices of teachers. Since the intention of the No Child Left Behind legislation was for teachers to integrate technology into their teaching practices (U.S. Department of Education, 2004), it is important to examine the effects, if any, of such programs on technology acquisition and on the beliefs of teachers about their own ability to utilize technology to enhance their professional or personal practices. The purpose of this paper is to present a synthesis of the past and current research literature that might inform an examination of this type and to evaluate these studies for their potential contribution to future research.
Organization of the Review

The review of literature will seek to elucidate the terminology associated with rapidly expanding field of technology-mediated learning and the place of Web-based training in that field. It will explore a definition of technology integration, as well as examining the factors that support or encumber this major change in classroom teaching expectations. Finally, the implications for professional development in this new digital context will be examined.

Interest, Significance, and Rationale for the Critical Analysis

Without a doubt, technology-mediated learning, or E-learning, has become an essential component of the educational scene (Holmes & Gardner, 2006). Killion (2002) employed the metaphor of a shopping cart to describe today’s E-learning educational options. Perhaps, however, E-learning’s virtual learning environments are more like an aisle in the educational superstore, offering a fresh variety of products from which educators and learners can pick and choose.

Web-based training using asynchronous tutorial-style instruction is one of the items on the E-learning aisle, and its distinct features have found increasing favor in business and industry for the delivery of instructional content (Paradise & Homer, 2007). Although this E-learning product is not new, Web-based training has been improved by updated programming and pedagogy and invites a second look by researchers and by stakeholders seeking to assist teachers in their acquisition of technology integration skills. However, Sitzmann, Kraiger, Stewart, and Wisher (2006) note that the growing popularity of technology-mediated instruction should not overshadow the need to
understand if the delivery medium is effective and if certain contextual or methodological factors moderate its effectiveness.

Since the theoretical constructs are at the heart of all studies, a review of the theories associated with distance learning, with professional development, with technology adoption, and with self-efficacy is a vital consideration for any researcher endeavoring to delve into the realm of instructional technology. Likewise, a critical analysis of the empirical data related to the use of technology-mediated learning in general and computer-based training in particular for the delivery of professional development might serve the interests of school districts who are considering the use of similar programs to augment the technology skills of their classroom teachers efficiently and effectively.

Review of Literature

The World Wide Web was born a little more than a decade ago with the invention of hypertext markup language (HTML), but even in its infancy, the Web empowered educators who sought to build frameworks for constructing and sharing knowledge (Foti, 2006). What educators have produced for teaching and learning, and what they continue to produce, is representative of that empowerment. Certainly, growing use of the World Wide Web for instruction has empowered education by extending classroom walls and allowing users to make thousands of decisions about the time, the place, the content, and the duration of their own learning—to effectively load their own shopping carts from the plethora of options on the digital shelves of the virtual market.
An Overview of Technology-Delivered Instruction: What's on the Shelf?

Technology-delivered instruction is still a developing field, and the terminology used to describe the techniques and systems of the field is still evolving. New digital products regularly vie for a place on the shelves, providing exciting options to educators and users in their attempts to promote learning. At the heart of technology-delivered instruction is the virtual learning environment. Pimentel (1999) provides researchers with a classic definition:

We define a virtual learning environment as one that allows learners to perceive the environment, assess situations and performance, perform actions and proceed through experiences and lessons that will allow them to perform better with more experience on repetition on the same task in similar circumstances. This definition of a virtual learning environment emphasizes the importance of learning. Learners in a virtual environment are expected to make use of and include examples, observations, experiences, situations, rules, concepts and techniques in a continuous (e.g., day by day or week by week), permanent (i.e., committing knowledge into memory) fashion to improve the performance of the execution of tasks. (Section IV, ¶ 3)

Adsit (2004) used the term technology-mediated learning (TML) to represent learning that is facilitated using electronic resources such as computers, Web-based resources, or digital video as the primary delivery or support component. Technology-mediated learning includes both computer-based training (also called computer-based instruction), in which instructional modules can be delivered through a digital media format like a CD-ROM or via a local Intranet, and distance learning, which implies the
delivery of instructional material across time and space. Computer-based training, as the original digital educational product, has actually been available in the online education aisle for nearly 20 years, and its development marked the beginning of E-learning (Clarke, 2002).

The E-learning aisle.

Ironically, the term most frequently associated with technology-mediated learning is the one that is perhaps most poorly defined. Romiszowski (2004), having found more than 20 different definitions in his research, lamented that unless an author expressly defines the term E-learning, there is little chance that the author’s understanding of the term will match that of his readers. Therefore, for the purposes of this study, E-learning will be defined as “the use of electronic means to deliver content, manage students through their learning, and test students on their comprehension” (Clarke, 2002, ¶ 7). This definition provides the most inclusive description of E-learning’s ability to provide anywhere, anytime access to education, and allows a consideration of both online and offline learning systems.

For analysis purposes, E-learning can be divided into two domains: (a) online study, which is synchronous in nature and communicated in real-time, and (b) offline study, which is asynchronous in nature and communicated in flexible time. Each of these can be further divided into group collaborative study (i.e., chat rooms, e-mail communication, discussion boards) or individual self-study (i.e., WebQuests, online or offline courseware, Web surfing) (Romiszowski, 2004).

WBT: An old product with new packaging.
Interestingly, as an online, individual self-study environment, *Web-based training* (WBT) blurs the lines between these groups. It differs from computer-based training, which relies upon locally installed software, because WBT must be completed online, thus capitalizing on the Internet’s potential for the delivery of anytime, anywhere learning. This new-and-improved variation on the old computer-based training product includes the familiar tutorial-style modules that serve to guide a user through an instructional program. Like computer-based training, Web-based training is usually *asynchronous* because not all participants are learning at the same time and *self-paced* because participants proceed through their studies or activities at their own speed (National Staff Development Council, 2001). In effect, WBT is CBT with the flexibility to learn in real-time from any online computer. For this reason, many studies that concentrate on computer-based training are applicable to the study of Web-based training. They are sister-products in the digital shopping cart.

An additional characteristic that separates Web-based training and computer-based training from other forms of E-learning is the fact that these do not require a facilitator or instructor after the initial orientation/enrollment process. In Web-based training, learners usually select and complete lessons through a learning management system (LMS), which provides the organizational features needed to assist users in locating their learning tasks. The lessons take the form of interactive tutorials that may include audio and video support. Whether locally-produced or commercially-purchased, many learning management systems offer prescriptive training, which prevents users from having to complete lessons on skills they have already mastered, pre-/post-test options, and usage/completion tracking. However, only in Web-based training can
learners be given active control all of the basic parameters of learning—time, place, content, and duration.

_The interest in E-learning products._

Learning online is a growing trend, and teacher professional development is a part of this trend (Pollard & Pollard, 2004; Valle & Duffy, 2004). When E-learning is employed to provide professional development for educators, it can be labeled *technology-mediated professional development* (TMPD) (Adsit, 2004). In addition, technology-mediated professional development (TMPD) must be differentiated from *technology professional development* (TPD), which specifically targets the development of technology skills and the classroom integration of those skills. TPD is an important subset of TMPD programs (Adsit, 2004). It might be expected that school districts would first turn to technology-mediated professional development to help their teachers acquire technology skills, inadvertently discovering its potential for providing professional development to meet other critical areas of teacher need.

The American Society for Training and Development reports that instructor-led trainings in industrial and business settings are losing ground to self-study through asynchronous Web- or computer-based training, which now accounts for 15 percent of all training delivered (Paradise & Homer, 2007). This change represents a twofold increase in one year, and efficiency and global access have been identified as the factors leading to this shift (Sugrue & Kim, 2004).

In fact, this globalization, which itself is the result of rapid technological change, is predicted to have a strong influence on workers of the future by forcing them to constantly update their skills. Nickols (1990) predicts a tremendous need for improved
technical training and education for all professionals as the late 20th century shift from manual work to “knowledge work” continues. Cornish (2004) anticipates that professional development will be considered a necessity throughout life: “The world of 2040 may even have laws requiring adults to continue their education so they can remain economically productive and play a constructive role in civic affairs” (p. 33). Ironically, according to Bok (1986), politicians and educators as early as the mid-1980s were arguing for the use of computer-based instruction to help employees develop new jobs skills required in an increasingly technology-centered workplace.

With this in mind, employing the use of TMPD for today’s teachers seems to adhere to a developing trend. The 2004 National Educational Technology Plan specifies that all teachers should have the opportunity to participate in online learning programs (U.S. DOE, 2004), and numerous quantitative studies offer evidence that online instruction is equivalent to traditional methods (Russell, 2001; Shachar & Neumann, 2003)

**Considerations related to TMPD.**

There are situations that might hamper teachers from receiving the support they need to acquire technology integration skills. A recent follow-up report from Technology Literacy Challenge Fund (TLCF) grant recipients indicated that lack of time to practice technology skills as one of the most significant barriers to increasing technology integration in the classroom (Adelman, Donnelly, Dove, Tiffany-Morales, Wayne, & Zucker, 2002).

Technology-based delivery for professional development offers several advantages for teachers, with flexibility of learning times and locations being a primary
consideration (Butler, 2006). In addition, technology-mediated professional development programs provide the ability to tailor the course offerings for teachers at various levels of technology acquisition. Jackson (1999) identified these various levels of technology acquisition as four distinct categories: (a) new users who have been previously uninterested in adopting technology; (b) teachers who employ limited technology for their personal use; (c) intermediate educators who are beginning to add technology to traditional classroom instructional methods; and (d) advanced users, who use technology for educational experiences that are not possible in the traditional classroom setting. The ability to meet the needs of users at varying degrees of technology adoption is a major difference between online professional development and the traditional face-to-face delivery methods.

Adsit (2004) reports that technology-mediated professional development programs for teachers can provide new resources for improving teaching and learning, for reducing teacher isolation, and fostering collaboration among teachers. However, this is more common when the TMPD includes opportunities for teachers to communicate within the online learning environment. In other cases, studies documented a deficiency of online professional development in its tendency to isolation of users who are accustomed to face-to-face interaction (Smith & Smith, 1993; Palmer, 1999).

Finally, technology-delivered professional development can improve teachers’ learning experiences by providing customized just-in-time learning, as well as providing increased opportunities on a global scale (CEO Forum on Education and Technology, 2001). However, while many studies indicate perceived learning and satisfaction with a
Web-based environment for learning, the dilemma for professional development seems to rest in the inability to provide conclusive evidence that teachers gain useful classroom skills or conceptual knowledge through its use. For example, Lebec and Luft’s (2007) recent mixed-methods study involved 7 social studies teachers enrolled in a 3-week online professional development module. The study reveals that participants were able to satisfy the instructor’s requirements (quantitative measure) while demonstrating little evidence of meaningful learning (qualitative measure). While the study’s design limits its generalizability, it reveals a real outcome in a real-world situation and speaks to the need for quality of design and critical review of online content.

*Evaluating non-traditional instructional delivery systems.*

Research in the area of technology professional development offered to teachers through an online delivery system is in its infancy. The studies sponsored by SRI International and prepared by Adelman, Donnelly, Dove, Tiffany-Morales, Wayne, and Zucker (2002) offer the first true comprehensive examination of teacher’s use of technology and the professional development that may or may not accompany that use. The Delphi study performed by Pollard and Pollard (2004) asked distance learning experts to predict the research needs of educational technology in the next five years; *determining best practice scenarios* and *developing online models of instruction* were listed as recommendations for educational research. In addition, the researchers determined that the same factors that affect learning in a traditional classroom—learner skills, prior knowledge, beliefs/attitudes, and course/lesson design—also affect learning in an asynchronous learning environment (2004). Of these four, beliefs/attitudes
(particularly those related to technology) and course design offer additional possibilities for critical examination.

Additional study is also indicated to determine the effectiveness of professional development programs offered through online delivery systems. In a qualitative case study comparison of two different teacher development programs intended to teach technology integration skills, Sandholtz (2001) identified three common criteria that could be used to measure effectiveness: (a) participants’ evaluations of their own learning experiences; (b) the gain in skills as the result of the program; and (c) the plans of the participants for using technology in their classrooms. These criteria might also be applied to an examination of participants using an online delivery system for technology professional development.

Finally, the key to successful adoption of technology by teachers is teacher pedagogical beliefs. Ertmer (2005) highlights the need for research into the relationship between teachers’ beliefs and their classroom use of technology, stating that her research indicates that it is impossible to overestimate the influence of teachers’ beliefs on classroom technology adoption.

*Changing America’s Classrooms: Who Is Pushing the Cart?*

Modern society has embraced the digital world for its economic advantages, its portability, and its ability to entertain as well as educate (Dooley, 1999). As computer technology has become more user-friendly, Molebash (1999) notes three trends that have had implications for the American education system: (a) the availability of cheaper, faster computing power; (b) the improvement of digital interfaces; and (c) the expansion of wireless communication systems. These trends have produced increased demands for
technologically skilled workers, and providing students with the technology skills needed to compete in a global market has become a part of school reform efforts (Donnelly, Dove, & Tiffany-Morales, 2002).

Cart-pushers: The national scene.

Professional development for the integration of technology into American classrooms is only one aspect of a broader set of educational reform issues that have ranged in scope from aligning state educational systems to implementing standards-based reform. Research done by Donnelly, Dove, and Tiffany-Morales (2002) supports their proposal that “the success of any educational reform approach depends not only on teachers’ belief in and will to implement the proposed changes, but the development of teachers’ professional skills necessary to implement such changes” (p. 5). They suggest that since the emphasis on technology growth has accompanied a focus on educational accountability, it is expected that the school reform movement would include instructional technology. For this reason, technology literacy is an important part of the No Child Left Behind Act of 2001.

Society’s adoption of computer technologies produced a need for classroom teachers to acquire new skills in order to meet the NCLB goal of having a high-quality teacher in every classroom (U.S. Department of Education, 2002). In 2000, these skills had been codified by the International Standards for Technology in Education into the National Standards for Educational Technology for Teachers (NETS*T). The following six areas were targeted: (a) technology operations and concepts; (b) planning and designing learning environments and experiences; (c) teaching, learning, and the curriculum; (d) assessment and evaluation; (e) productivity and professional practice; and
(f) social, ethical, legal, and human issues. These standards have been widely embraced and are adopted, adapted, or referenced in 90% of state-level technology-implementation plans (International Society for Technology in Education, 2002).

Each area outlined in the NETS*T offers an opportunity for targeted professional development for classroom teachers. However, in a national study completed in 2003, while 85% of American’s teachers in 2003 reported feeling *somewhat well-prepared* to use technology for classroom instruction, nearly 40% still expressed an interest in learning basic computer skills (U.S. Department of Education, 2003). The same study reports that over 60% of all teachers indicated that *time to learn and practice skills* was a primary barrier to the use of educational technology, but they almost unanimously indicated a need for and a willingness to obtain additional technology-related professional development, particularly in the area of technology integration into instruction.

Inevitably, while the nation continued to struggle to meet the needs of its classroom teachers, technology raced forward. The introduction of tools now labeled as *Web 2.0* changed forever the way society interacted with Internet content by moving the Internet from a *read-only* interface to a *read-write* one (Richardson, 2006). The social networking technologies of Web 2.0 allow users to interact through *microcontent*, small blocks of information that can be “saved, summarized, addressed, copied, quoted, and building into new projects” (Alexander, 2006, p. 33). Social networking technologies encourage interaction among users by allowing them to share common interests, by providing online collaborative space, and by adding content to sites created by others.
Almost overnight, users had to the ability to add to the body of Internet content without knowing a single command in a computer programming language.

In response, ISTE felt a need to refresh the NETS*T to “provide a framework for educators as they transition from Industrial Age to Digital Age places of learning” (International Society for Technology in Education, 2008b, ¶ 2). The new standards, released in 2008, clearly indicate the rapidly changing face of technology for the classroom teacher and reflect the increasing demands inflicted upon them by 21st century sensibilities. Gone is the concentration on technology operations and standards, which ISTE apparently assumes all teachers know. The operational standards of the 2000 version have been replaced by a focus on (a) facilitating and inspiring student learning and creativity; (b) designing and developing digital age-learning experiences and assessments; (c) modeling digital-age work and learning; (d) promoting and modeling digital citizenship and responsibility, and (e) engagement in professional growth and leadership (International Society for Technology in Education, 2008a). These standards reflect a growing awareness of the role that technology will play in future classrooms and workplaces.

Unfortunately, neither ISTE nor NCLB delves into questions concerning how to recognize the high-quality professional development needed to help teachers meet these standards or how to effectively and efficiently make this professional development available to teachers (Neville, Sherman, & Cohen, 2005). This task was left to be addressed on the state and local levels.

*Cart-pushers: The state and district scene.*
As teachers stumble under unprecedented technological and academic demands placed upon them in the 21st century, there is a greater awareness by all stakeholders of the need for professional development (Donnelly, Dove, & Tiffany-Morales, 2002). Unfortunately, the increased attention to teacher quality leaves stakeholders facing huge challenges with little data to guide them in achieving their goals (Neville, Sherman, & Cohen, 2005). This is also the case at the state and district levels, where boards of education grapple with how to help teachers meet these requirements set by No Child Left Behind Title II, Section D (NCLB IID) legislation and the Technology Standards included in most state Technology Plans.

Federal funding for NCLB IID—the Enhancing Education Through Technology (EETT) block allocation program—provides some local support for state and local agencies attempting to implement the program. In addition to the 25% set aside for “ongoing, sustained, and intensive, high-quality professional development,” Local Educational Agencies (LEAs) are instructed to develop and utilize innovative distance learning strategies to “deliver specialized or rigorous academic courses and curricula to areas that would not otherwise have access to such courses and curricula” (U.S. Department of Education, 2002, Section 2412.a.2).

Unfortunately, the government’s increasing federal involvement in the nation’s public school systems has not kept pace with federal funding for its initiatives (Anderson, 2004). The systematic cuts to the EETT allocation program over the past four years have placed in jeopardy many of the programs NCLB IID set in motion (State Educational Technology Directors Association, 2008). It can be surmised that local school boards, already shouldering the economic burdens of meeting other federal guidelines for which
insufficient financial support was allocated, have been forced to make uncomfortable decisions. For example, the National Association of School Boards of Education Policy Update (2006) indicated that while 40% of a district’s technology budget should be earmarked for professional development, the actual figure averages only 17%.

For many school districts, the dollar will necessarily become the bottom line, and it will determine what professional development products are placed in the shopping cart. Borko’s (2004) studies revealed that the key to promoting personal growth and teacher effectiveness is high-quality, in-service professional development that can be easily accessed by teachers. In an effort to address the needs of their teachers in an effective, efficient manner, school districts in increasing numbers are considering the use of technology-mediated trainings as opposed to the more costly face-to-face professional development offerings (Butler, 2006).

For a school district, technology-mediated trainings can be financially beneficial. Driscoll (1999) points out that there are benefits in addition to the obvious one: reduced travel time and the associated travel costs. She includes reduced printing costs, reduced opportunity cost (in particular, time away from job), and reduced turn-around time for the release of new initiatives. Of particular interest to school districts is Driscoll’s observation that the use of online training programs also helps to justify the funds already invested in computers, networks, and servers (1999).

*Cart-pushers: Teachers seeking technology integration.*

The use of technology in education is not new. Donnelly, Dove, and Tiffany-Morales (2002) are quick to remind researchers that teachers and schools have rapidly embraced other technologies, including typewriters, mimeographs, television, and
overhead projectors. Based on an exhaustive literature review, they propose that this is largely because those technologies made teacher’s professional responsibilities easier and because teachers perceived these technologies as good motivators for students.

However, while today’s generation of school children are digital natives, or n-gens, who have never known a world without computer technology, most teachers are digital adopters. As a result, education has lagged behind the latest trends and is just beginning to feel the effect of this lag (Downs, 2005). To understand the speed at which American teachers were left behind, the National Governors’ Association, in partnership with the Milken Exchange on Educational Technology (1999), published this analogy as part of its policy guidelines for state governors:

Until 1993, [the Internet] was a slow-speed, text-based system used mostly by university scientists to converse with one another. When it exploded into the public consciousness in 1994, enhanced by high-speed communications networks and a graphics interface, it took only four years to engage 50 million users. It took radio 38 years and television 13 years to reach the same audience. (p. 24)

As a result, teachers who have not yet added computer technology to their personal skill sets may now find themselves in an uncomfortable position—forced to utilize the classroom technology that districts have placed at their disposal but unfamiliar with the basic skills to make it happen. It might be expected that teachers who lack basic technology skills will have difficulty integrating technology into their classroom practices.
Defining Technology Integration

Adding to this dilemma is the fact that the definition of teachers’ use of technology has not been clearly established. During the early years of this decade, there appears to have been a lack of a common understanding concerning what technology integration looked like when it was implemented in a classroom. Bebell, Russell, and O’Dwyer (2004) employed a multiple-measures approach to assess teachers’ use of technology. Their research suggested that the establishment of distinct categories of technology use would provide school districts with a richer understanding of the extent to which resources and professional development are impacting classroom instruction.

Measuring technology integration.

Assisting in this effort were studies conducted by the Northwest Educational Technology Consortium (NETC) that served to quantified the effective use of educational technology (2005). Their Observation Protocol for Technology Integration in the Classroom (OPTIC) provides a detailed framework for collecting information needed to assess technology integration. To summarize, NETC proposes that technology integration is occurring if:

1. Teachers are trained in a full range of technology uses and in the determination of their appropriate roles and applications.

2. Teachers and students routinely turn to technology when needed.

3. Teachers and students are empowered and supported in carrying out those choices. (2005, p. ¶4)

ISTE’s National Educational Technology Standards for Teachers (NETS*T) (2008a), together with the National Educational Technology Standards for Students...
(NETS*S) (2007), form the theoretical framework for technology integration. However, meeting these standards in a classroom setting often proves difficult. Both the NETS*T and the NETS*S standards are unique in that they address all content areas, unlike specific subject area standards. Keeler (2008) feels that there is an “expectation that teachers of all disciplines [will] use the standards for productivity and instructional purposes and that they [will] prepare their students to competently use technology by integrating the standards throughout instructional delivery” (p. 23).

However, in order for technology integration to occur, teachers must also mesh the technology standards with their own content-area standards that also contain statements concerning the importance of integrating technology (Keeler, 2008). Thus, technology integration requires that teachers transfer their technology learning into their content area. Perhaps this gives the impression to teachers that they are, indeed, two separate areas of study rather than one skill enhancing the other. Keeler’s action research involved more than 1000 pre-service teachers over a four-semester period in a technology-rich educational methods course. She concluded that even when students know how to use specific technology tools, they have problems using the tools in an educational context. Keeler suggests that university content methods instructors must teach instructional strategies that mesh with 21st century tools and 21st century content, creating a unified process for technology integration (2008).

It is interesting to note that this blending of subject matter, technology skills, and educational methods has been suggested as a new way to look at technology integration. The combination of technology, subject-specific content and instructional pedagogical methods has been termed TPACK (Technology, Pedagogy, and Content Knowledge) by
Mishra and Koehler (2006). Earlier known as TPCK, this framework is based on the authors’ belief that a teacher who is able to blend these three components successfully is demonstrating a new expertise that is different from that required to meet each of the three areas individually.

There is great interest in Mishra and Koehler’s TPACK framework from the educational technology community. If the framework is found to be effective in describing the process of technology integration and guiding observation, it will have a profound effect on the way professional development for technology integration is delivered. Rather than simply learning to use available tools, teachers will need to learn how to replace obsolete technologies with their newer counterparts, applying the new technologies to their relatively stable content and adapting the pedagogy to create a unified whole. In this way, overall teacher knowledge will be directly tied to the knowledge of technology (Mishra & Koehler, 2006).

*Supporting technology integration.*

A recent report from the National Center for Educational Statistics emphatically highlights the changes in technology for America’s classrooms during the past decade (Parsad, Jones, & Greene, 2005). Schools districts have experienced intense pressure to provide computers and connectivity to classroom teachers, and they have met the challenge though a combination of local and federal funding. In 1994, only 3 percent of all public schools instructional rooms (areas in which instruction actually occurs) in the United States had access to the Internet. By 2003, this number had risen to 93% percent, representing approximately 100% connectivity for public school buildings (Wells & Lewis, 2006).
Decreasing size and cost for increasing computer power is another developing trend that has stimulated a high rate of adoption of computer technologies in American schools (Donnelly, Dove, & Tiffany-Morales, 2002). Shlechter (1991) declared that hardware and software manufacturers, who saw a huge market for technology-related products, also spurred the use of computers in classrooms. These manufacturers encouraged technology growth within school systems by donating equipment but neglecting to include professional development plans for users of the equipment. Cuban, Kirkpatrick, and Peck (2001) report that many parents, corporate executives, and policy makers assumed that access to equipment and software would lead to abundant classroom use. Instead, nonusers remained nonusers, and even when computers were used for classroom work, teachers did not change their teaching practices.

Unfortunately, the effective professional development that teachers need to unlock the potential for their own productivity and for student learning has been slower to materialize. There continues to be a divide between access to technology and the actual use of technology in classrooms, and much of this divide has linked to teacher preparedness (Trotter, 1999; CEO Forum on Education and Technology, 2001). In fact, Molebash (1999) notes that other fields have embraced changes resulting from increased technology availability much faster than education has. He points out that a surgeon of 100 years ago would be totally lost were he to walk into a 21st century operating room; however, a teacher of 100 years ago would be able to step into most modern American classrooms without any major discomfort. Molebash’s observation lends supports the idea that while most classrooms have been outfitted with computers and Internet access,
integration of computer technology into teaching and learning practices has not yet widely occurred.

In their efforts to explain the apparent lack of change in classrooms despite changes that have shaped other institutions because of technology, Donnelly, Dove, and Tiffany-Morales (2002) suggest two contributing factors: (a) the difficulty in quantifying the educational benefits of classroom technology use, and (b) the inadequacy of staff development compared with employee training in the private sector.

One problem, of course, is that despite substantial investments in educational technology, it has proven difficult to show that these investments are actually changing teaching and learning in schools (McNabb, Hawkes, & Rouk, 1999). A national study by Becker (1999) indicated that the majority of teacher technology use is not focused on technology integration but on lesson planning, grading, and e-mail. While these activities are evidence of technology use by teachers for professional responsibilities, there has been no recent definitive research to countermand Becker’s findings. Cuban (2001) agrees that real change is the classroom has been slow to materialize; he surmises that a slow-revolution must occur to change teachers’ beliefs about teaching and learning. Specifically, Rogers (2000) identified six main barriers to technology integration: (a) the attitudes and beliefs of stakeholders, (b) the skills of stakeholders, (c) the accessibility and availability of technology, (d) the level of technical support available, (e) the level of funding available at the school and district level, and (f) time to learn and practice technology skills, as well as time to include technology as part of daily lessons.

The NASBE’s Policy Update (2006) indicated that perhaps teachers are receiving a mixed message regarding technology: districts expect them to integrate technology into
their classrooms without the necessary support to do so. The NASBE’s Policy Update (2006) revealed findings by the Web-based Educational Commission that compared the type of professional development support offered to those in education and to the support available in the private sector. The Commission found that teacher support tended to take a one-size-fits-all approach, while the Commission deemed the support available in the private sector as targeted and timely. The Policy Update also noted that unlike other professionals, educators did not receive incentives for using technology and that noted the most technologically savvy educators were being lured into higher paying jobs in industry (2006). Neville, Sherman, and Cohen (2005) also note that education is alone in lacking a single-entity to enforce universally accepted standards that can be used to judge the caliber of professional development. Their report on the financing of education indicates that education, unlike most other professional fields, grants the power for choosing professional development activities to schools and districts, and they highlight a need for a single, solid criteria to evaluate providers and their offerings.

Technology integration as change.

Several learning theories contain elements that can be applied to the adoption of technology use by teachers, and a common thread in each concerns change. Technology integration will necessarily involve both adoption and adaptation, and these changes may be hard for seasoned teachers. These theories and models bear consideration for work in the online environment, even though they were developed for the traditional learning settings.

The Diffusion of Innovations Theory (DoI) proposed by Rogers (1962) offers a framework for examining two important parts of teacher buy-in for technology use: the
process of adopting technology for their own use and the process of implementing the technology into their classrooms. Rogers proposes that the process through which a new technological idea gains acceptance is a social one. The innovation must pass through five distinct stages:

1. *Knowledge* refers the initial exposure to and understanding of the functions of a new technology.

2. *Persuasion* represents the formation of an acceptable or favorable attitude toward the new technology.

3. *Decision* involves an individual’s conscious commitment to adopting this new technology.

4. *Implementation* refers to the individual’s actual attempts to use the technology.

5. *Confirmation* is achieved from positive outcomes that reinforce use. (Rogers, 1962).

Successful technology-mediated professional development would necessarily have to address each of these steps, helping to bridge the gap between the different types of adopters as described by Rogers: innovators, early adopters, early majority, late majority, and laggards. In addition, Rogers describes the characteristics upon which any technology innovation will be judged. These include: (a) *relative advantage*, or how the innovation is perceived to be better than a previous technology; (b) *compatibility*, which refers to the fit of the innovation with existing experiences or needs; (c) *complexity*, which relates to the innovation’s perceived difficulty of use; (d) *trialability*, or the
possibilities offered for experimentation with the technology; and (e) *observability*, or the degree to which results of use are visible (1962).

The Concern-Based Adoption Model (CBAM) adoption model developed by Hall, Wallace, and Dossett in 1973 views change as a process rather than an event and looks at the motivations, attitudes, and feelings experiences by individuals as related to this change (Hall & Hord, 2005). In this model, *change* is a gradual progression in which skill in the use of an innovation is developed, and *concern* represents the thoughts and perceptions applied to a task by an individual. Each stage of concern is associated with a pattern of intensity linked to the level of change taking place. Hall and Hord (2005) expand on these ideas by further defining change. They stress that individuals must change before an organization will change and that facilitation of this effort is requires leadership, buy-in, and appropriate interventions.

One part of the Concern-Based Adoption model is the Stages of Concern dimension. Hall and Hord (2005) describe Stages of Concern (SoC) as a measure of the perceptions and feelings an individual has toward an innovation and define seven stages of acceptance that form a continuum during which an individual’s focus shifts from personal to global.

The first three levels represent a concern for the individual, or *self concerns*: (a) *awareness*, in which an individual is introduced to an innovation, (b) *information*, in which the individual examines an innovation for its properties and begins acquiring skills, and (c) *personal*, in which the individual questions how this innovation can be helpful in his or her own practice. At these stages, professional development focused on skills acquisition is important, and Web-based training can be an appropriate support
mechanism. The middle level is termed *management*, during which the individual practice the task or innovation and seeks mastery; at this *task concern* level, support is a key element for success and may be provided through online communication. The last three stages find the individual looking outside for additional information and can be termed *impact concerns*: (a) *consequence*, in which the individual evaluates the innovation for its worth; (b) *collaboration*, in which the individual seeks contact with others to ascertain other ways to use the innovation; and (c) *refocusing*, in which the individual critically compares the innovation with other similar tasks or products (Hall & Hord, 2005). In an online environment, these impact concerns can be addressed using asynchronous discussion boards that link learners to others who are experiencing similar concerns.

Clarke (1999) proposes that Rogers’s Diffusion of Innovations Theory is a strong tool for describing the process of adopting technology innovation; however, he cautions that it is not as strong in explaining why these stages occur or in predicting outcomes or providing guidance concerning how to increase the rate of technology adoption. Similarly, Sherry and Gibson (2002) have raised objections to both CBAM and DoI. They site problems with the assumption by both models that an educational system is a single social system working towards a unified goal. Instead, they emphasize organizational subsets that have developed in school systems as the result of external factors including the rapid evolution of the Internet. Therefore, Sherry and Gibson argue that adoption theories must include consideration of the flow of resources into a system and must provide both a framework and a language for describing simultaneous interactions. Finally, they propose that the involvement of all parts of the system and all
players must be visible. As a result, they propose that Rogers’s theory should be modified and have developed a professional growth model that they call the Learning/Adoption Trajectory (Sherry & Gibson, 2002).

The Learning/Adoption Trajectory identifies four stages through which educators must be led as they learn instructional technology in order to integrate it into their daily teaching practices: (a) teacher as learner, (b) teacher as adopter, (c) teacher as co-learner, and (d) teacher as reaffirmer or rejecter (Sherry & Gibson, 2002). This model identifies the relationships among teachers in the learning process and recognizes the need for interactions among learners. The model proposed by Sherry and Gibson is particularly important to consider when examining the use of online learning communities for enhancing technology acquisition.

Ertmer (2005) examines the consideration of the teacher beliefs as an additional dimension to understanding technology acquisition. Her well-documented study examines the relationship between pedagogical beliefs and technology practices of teachers. She references Rokeach’s work on belief systems as she outlines how beliefs are changed by describing a belief system using the metaphor of an atom. In this analogy, core beliefs, represented by the nucleus of the atom, are labeled Type A beliefs, formed by personal experiences and shared with or confirmed by others; these are highly resistant to change, as are Type B beliefs, which are those beliefs held privately but still based on personal experience. Ertmer suggests that beliefs about the nature of teaching have been formed over many years and are highly resistant to change; this resistance will influence how new information is processed. Further, she insists that even if technology
skills are learned, they are likely to be unused unless they fit with a teacher’s pedagogical beliefs:

It is imperative that we increase our understanding of, and ability to address, teachers’ beliefs as part of our efforts to increase teachers’ technology skills and uses. In the best of all worlds, then, this will not only enable teachers to use computers to their full potential but will enable students to reach theirs as well.  
(Ertmer, 2005, p. 27)

Despite development for the face-to-face environment, these theories related to how individuals adopt and adapt are entirely applicable in the digital world. In fact, if practitioners can predict how concerns will change, professional development opportunities can be planned to address those needs. It would appear that how teachers feel about an innovation will largely determine if that innovation will actually be brought into the classroom. Dooley (1999) proposes that it is not enough simply to instruct a teacher on the use of hardware and software; teachers must see how to integrate it into their curriculum.

Professional Development in the Digital Age

The very idea of professional development for public school teachers is a relatively new one, developed in the 1970s as educators and researchers sought to ensure that teachers could meet increasingly higher demands (Peixotto & Fager, 1998). Research has revealed several important characteristics that mark effective staff development. It would not be surprising to learn that these characteristics extend into the digital world.

An evaluation of the Eisenhower Professional Development Program, which sought to determine the characteristics of professional development that improved
teaching practice, includes case study data and longitudinal study data obtained from a
national cross-section of America’s classroom teachers (Porter, Garet, Desimone, Yoon, & Birman, 2000). The three-year study outlines two key categories that earmarked high
quality professional development. *Structural* characteristics were those involving the
organization of the activity, the duration of the activity, and the extent to which teachers
are grouped with others who share like interests. *Core* characteristics included the degree
to which the activity provided opportunities for active learning, the extent to which the
activity focused on content, and the degree to which the activity was consistent with state
goals or standards (2000). Additional studies outlined by Donnelly, Dove & Tiffany-
Morales (2002) suggest that two additional characteristics should be added: first, *accessibility* of the activity and inclusiveness of the invitation to participate; and second, *incentives* for teachers to participate.

These four main characteristics—structure (context), core (content), accessibility, and incentives—can also be used to examine any form of online training that is part of a
comprehensive professional development plan. It is not surprising that these
characteristics apply to both face-to-face delivery and technology-mediated delivery, and they appear as recurring themes in most discussions and research about quality
professional development.

*Technology-mediated professional development.*

The meteoric growth of technology nationwide has produced improved graphical
interfaces, fiber optic networks, and wireless communication systems, all of which have
further added to the feasibility of using technology-delivered instruction (Donnelly, Dove & Tiffany-Morales, 2002). However, while researchers during the past three decades
have produced much information in professional literature about what is required to provide quality professional development in traditional trainer-centered, face-to-face environments, only recently has attention been turned to using immerging technologies to provide teachers with access to quality online professional development.

Research on traditional staff development has burgeoned in recent years as the result of new theoretical models, but research on technology-mediated professional development is still in its infancy (Adsit, 2004). Even so, Guskey (2003) reports, “There is little agreement among professional development researchers or practitioners regarding the criteria for effectiveness in professional development” (p. 17). Likewise, research is needed to measure the actual effectiveness of technology-mediated programs when they are used to provide staff development for classroom teachers.

Standards for TMPD.

One way to begin developing tools to measure effective TMPD programs was the establishment of standards for online teaching and learning. E-Learning for Educators: Implementing the Standards for Staff Development (National Staff Development Council, 2001) is a targeted spin-off from the NSDC’s standards for general professional development and represents an attempt to quantify technology-mediated professional development. These standards are echoed in the work of Guskey and Sparks (2002) whose case studies test a theoretical model describing the relationship between professional development and improvements in student learning; they succinctly comment that if “professional development does not alter teachers’ professional knowledge or their classroom practices, little improvement in student learning can be expected” (p. 5).
Killion (2002), in her review of the NSDC’s standard and recommendations, highlighted specific areas that districts should consider before selecting and implementing an E-learning program. The focus on structure (context), core (content), accessibility, and incentives evident in these recommendations is evocative of the findings of Donnelly, Dove, and Tiffany-Morales (2002) and Porter, Garet, Desimone, Yoon, and Birman (2000). Ten of her recommendations are below:

1. Results: There should be evidence of a link between staff development and student learning, thus holding E-learning as accountable as traditional learning.

2. Quality Learning Experiences: Courses should be standards-based, accommodate adult learning styles, and be subjected to evaluation.

3. Content Quality: Content should deepen teachers’ content knowledge and content-specific pedagogy.

4. Content Flexibility: Content format should allow flexibility that allows learners to control what and how they learn.

5. Flexible Time: Scheduling of online professional development time should occur within regular work time to avoid teacher isolation.

6. Learner Readiness: Since E-learning requires self-direction, motivation, and independence from learners, the drop-out rate is higher. Districts should consider some kind of support to increase participation.

7. Meeting Learning Needs: E-learning should provide opportunities even for teachers with unique teaching roles.
8. Follow-up Support: Learners are more successful in transferring knowledge or skills in the classroom when long-term support from experts is available.

9. Interactivity: Districts should consider how interactivity is structured and how often it occurs.

10. Cost: Total costs for E-learning must include both financial and human resources investments. While TMPD programs are not always less expensive than traditional programs, they may be more convenient and more flexible. Hidden costs include travel, substitute teachers, facilities, equipment, electricity, materials, consultants, and support. (Killion, 2002)

Not mentioned in this list is the importance of incentives for participation although there is mention of the NSDC’s recommendation that teachers spend 25% of all professional working time in learning or in collaboration with other teachers (National Staff Development Council, 2001). Killion concludes by warning that all of the bells-and-whistles possible with TMPD may be attractive, but the bottom line is that technology-mediated professional development, whatever synchronous or asynchronous, is not a stand-alone program and should be integrated into a comprehensive staff development program (2002).

The newer Standards for Online Professional Development (Griffin, 2004) are based on the Southern Regional Education Board’s Standards for Professional Development. These standards expanded the standards set forth by the NSDC by addressing the same key issues but include indicators for the context, the content, and the process of E-learning. These standards provide more specific information meant to guide online professional development creation and choices.
Factors that influence learning in an online setting.

Like face-to-face learning, E-learning is influenced by the instructional method, characteristics of learners, and the context of the experience. A meta-analysis of 10,910 learners by Sitzmann, Kraiger, Stewart, and Wisher (2006) clearly details the differences in the two environments for each of these elements. Instructional methods refer to the actual techniques used to share course content (i.e., lectures, assignments, readings). The researchers found that in most cases, the organizational structure in a Web-based training platform mirrored that of a face-to-face classroom. Course planners utilized the same methods and merely substituted comparable methods for those missing in the online environment. The resulting analysis suggests that instructional methods determine learning rather than delivery method (2006). Regarding learner characteristics and experience context, Sitzmann, Kraiger, Stewart, and Wisher also discovered that trainees learned better in the online environment when they were provided control, when they practiced the training material, and when they received feedback on their practice (2006).

Fishman, Best, Foster, and Marx (2001) acknowledge the work of Richardson (1996) in identifying a strong correlation between teachers’ knowledge, beliefs, and attitudes (K/B/A) and teachers’ classroom practice. Their research identifies four elements—content, strategies, media, and sites—as variations on professional development that can impact teacher K/B/A. While not specifically targeting technology-mediated professional development, Fishman, Best, Foster, and Marx (2001) define a site as a place or context in which teacher learning may take place, noting that the context, media, and content will vary according to the situational needs of the teachers involved. By this definition, an online environment must also be considered a site, with its own
media, strategies, and content, as well as unique strategies based on the needs of the learners.

Because it is not possible to observe learners directly in an online environment, little information is known about the habits of users. The methods in a limited study by Valle and Duffy (2004) might be particularly useful for others studying Web-based training. In this qualitative study, a group of 20 participants self-selected into a series of short, Web-based, asynchronous courses in which they had the freedom to work as they chose over a period of time. Valle and Duffy examined the characteristics of users in an online learning environment using hierarchical cluster data to reveal three naturally-occurring groups: (a) task oriented users, who complete assignments quickly and efficiently; (b) grade oriented users, who take their time completing modules and invest only intermediate effort; and (c) goal oriented users, who were self-driven and show the highest usage time and commitment. The authors conclude that different learners make different uses of the flexibility available in online coursework and stress the need for providing enough resources to meet the needs of all learner types. They also note that knowledge of user characteristics might be helpful in knowing what kind of mentoring to provide (2004).

*Computer self-efficacy.*

The identification of a factor termed computer self-efficacy may serve assist districts seeking to understand user characteristics and patterns of computer use or disuse in order to target professional development opportunities. Work in this area is largely based on Bandura’s (1986) Social Cognitive Theory, which identified self-efficacy as an influential factor affecting behavior. Bandura defined self-efficacy as “people’s
judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is not concerned with the skills one has but with judgments of what one can do whatever skills one possesses” (p. 391). Although Bandura admits that self-efficacy will not determine if an action will be taken, he regards it as an effective tool for explaining human behaviors. Bandura listed four major sources of efficacy expectations that he considered part of a complex process of self-persuasion:

1. *Performance mastery experiences* are related to successful accomplishment of a task. Bandura viewed this as the most influential source of self-efficacy formation since it provides authentic evidence.

2. *Vicarious experiences* allow individuals to consider the successes of others and apply it to their own potential for success.

3. *Verbal persuasion* imparts a kind of social influence in the form of a logical argument that an individual can or cannot be successful.

4. *Psychological states* allow individuals to judge their strengths, capabilities, and even vulnerabilities. (Bandura, 1989)

Pajares (1996) summarized the self-efficacy perceptions proposed by Bandura quite simply: “People engage in tasks in which they feel competent and confident and avoid those in which they do not” (p. 544). With this in mind, Pajares examined the implications of Bandura’s work in academic settings, noting that research to that point had not been successful in clarifying the relationship between self-efficacy beliefs and self-regulatory strategies such as motivation and achievement. Specifically, Pajares reminded researchers that global or omnibus assessments are inappropriate because self-efficacy is an assessment of an individual’s ability to perform specific tasks. The specific
nature of self-efficacy is, in fact, what separates it from self-concept, which is more
domain specific and less context dependent. Further, he suggests that future investigators
might seek to develop a better understanding of self-efficacy beliefs as causal factors
since these beliefs can be altered by influences like verbal persuasion and performance
feedback (Pajares, 1996).

As extension of Bandura’s self-efficacy work, Compeau and Higgins define
computer self-efficacy as “a judgment of one’s capacity to use a computer” in the future
(1995, p. 192). The concept represents users’ perceptions of their own abilities to use
computers to accomplish a task, and this perception is separate from an evaluation of any
skills they might have learned. The instrument they devised was tailored to specific
computer tasks and was based on the work of earlier researchers. It attempts to measure
three dimensions of computer self-efficacy:

1. **Magnitude** is the level at which an individual judges he or she will need
   support. Individuals with low computer self-efficacy magnitude might judge
   themselves as requiring more support and assistance to complete computer-
   related tasks.

2. **Strength** is the perception an individual has concerning ability to perform a
   task. Individuals with low computer self-efficacy strength would perceive
   themselves as unable to accomplish more difficult tasks and would reflect lack
   of confidence and frustration.

3. **Generalizability** is the degree to which an individual’s perception of abilities
   is related to one particular area. Individuals with low computer self-efficacy
generalizability perceive themselves as being unable to transfer their skills, or generalize them, in other similar areas. (Compeau & Higgins, 1995)

In a follow-up longitudinal study of 394 users using a modified version of Compeau and Higgins’s computer self-efficacy measurement instrument, Compeau, Higgins, and Huff (1999) found a strong confirmation that computer self-efficacy, as well as outcome expectations, have a significant impact on an individual’s reactions to the use of information technology. The researchers conclude that low self-efficacy, “if not managed, will pervade an individual’s behavior to a significant extent over a prolonged period of time” (p. 155). They compare this effect to a downward spiral, where low computer self-efficacy lead to low performance, which leads to lower self-efficacy, suggesting that training programs and other support mechanisms need to be in place in advance of beginning the trainings. The longitudinal nature of this quantitative study also allowed the researchers to reach the conclusion that low self-efficacy does not vanish as experience is gained. Rather, low self-efficacy continues to predict usage and should be a factor in choices about what and how technologies are adopted, introduced, and supported (Compeau, Higgins, & Huff, 1999).

Measuring computer acceptance.

In early investigations concerning computer self-efficacy, Davis’s (1989) research concerning user acceptance of computer technology is often cited as a pillar upon which other investigations were based. Davis’s examination of outcome expectations produced new measurements scales for both perceived usefulness and perceived ease of use as determinants of acceptance by users of computer technology. Grounded in Ajzen and
Fishbein’s Theory of Reasoned Action, the Technology Acceptance Model (TAM) proposes that these factors influence an individual’s decision concerning technology use (Davis, 1989).

Using this Technology Acceptance Model (TAM), Davis found perceived ease of use to be a causal antecedent, rather than a parallel determinant, of computer use. In other words, computer technology that is perceived to be easy to use will be used, and usage will produce additional examples of usefulness, thus producing additional effective usage. Davis suggested further research that would address the relationship between perceived ease of use and usefulness, as well as methods that would allow for more objective measurements of these constructs (1989).

Venkatesh and Davis (2000) expanded the Technology Acceptance Model into TAM2, which focused on the perceived usefulness construct by including both social influence processes and cognitive influence processes into the TAM model. They defined perceived usefulness as the degree to which an individual believed that using a technology would enhance job performance; perceived ease of use was defined as the degree to which an individual believes that using a technology will be free of effort (2000). Social influences were identified as forces that provide an opportunity to accept or reject a new technology skill or system and included the following:

1. **Subjective norm** is an individual’s perception that others who are important to the individual feel that the behavior should or should not be performed.

2. **Voluntariness** is the degree to which an individual perceives that the decision to use a technology is voluntary.
3. *Image* is extent to which an individual perceives that the use of a technology will enhance or elevate his or her status with others in the workplace.

(Venkatesh & Davis, 2000, pp. 187-189)

_Cognitive influence_ processes represent factors that link behaviors to higher-level purposes or goals, such as how well a technology will match important work goals. These included the following:

1. *Job relevance* is an individual’s perception of the degree to which a targeted technology is applicable to his or her job.

2. *Output quality* is an individual’s perception concerning how well a technology performed tasks related to his or her job.

3. *Result demonstrability* is degree to which an individual can attribute gains in job performance to the use of the technology.

4. *Perceived ease of use* is a factor that was carried over directly from the TAM model as it was shown to be a direct determinant of perceived usefulness. It refers to the perceived degree of effort attributed to technology use by the individual. (Venkatesh & Davis, 2000, pp. 191-192)

Venkatesh and Davis utilized a longitudinal study of 156 individuals from four different organizations, half of which introduced a new technology system as mandatory for their employees. Their findings imply that the social influence to increase positive perceptions is more effective over time than the use of mandatory approaches to introducing new technologies. In addition, practical interventions such as demonstrating the advantages of a new technology over what is currently being used can be an important step for increasing user acceptance. The researchers note their findings
underscore the continuing trends of organizations away from top-down command-and-control structures and toward empowerment of users.

*Adult learners.*

The goal of any professional development, whether traditional or technology-mediated, is to ensure that it will actually alter a teacher’s knowledge or practice. Several frameworks exist that can help researchers to understand or to predict responses from teachers to professional development. These existing theories provide frameworks that contribute to an understanding of adults as learners.

Time-on-task and teacher isolation represent only a small portion of what should be considered when evaluating the use of technology-mediated professional development programs. McKenzie (1999) offers additional suggestions to improve professional development for educators. Highlighting his definition of the term *training* as “what we do to dogs and pigeons,” (p. 67) and his definition of *staff development* as “what we do to teachers,” (p. 67), McKenzie suggests implementing the ideas of *andragogy* based on the work of Knowles (1988). Knowles’s sometimes controversial postulates include five assumptions intended to separate the adult learner from the child learner. These assumptions are summarized below:

1. Adult learners possess an independent self-concept; they are capable of and desirous of directing their own learning.

2. Adult learners have a “reservoir of experience that becomes an increasing rich resource for learning—for themselves and for others” (p. 44).
3. Adult learners usually know what they want to learn, and their readiness to learn is influenced by their perception that a program is organized toward their personal goals.

4. Adult learners are more problem-centered and often seek an immediate application of knowledge.

5. Adult learners are motivated by internal, rather than external, factors.

(Knowles, 1988)

The work of Knowles has its critics in professional literature. Merriam and Caffarella (1999) discuss the philosophical debate that questions if Knowles’s assumptions are merely principals of good teaching practice rather than theory. Cercone (2008) cites other concerns about the lack of connection to learning context with Knowles’s work and concludes that andragogy, while not perfect, has contributed to a researcher’s understanding of adult learners.

Work in adult education has also been influenced by the research of Mezirow (1997). His contributions to the theory of transformational learning included the proposition that an individual learns through a change in his or her way of seeing the world—essentially, from an ethnocentric perspective through critical reflection. This constructivist theory of adult learning describes learning as the process of altering, or transforming, the attitudes, beliefs, and perceptions of an individual who is embroiled in his or her own history. Therefore, adult learning is the process of using prior knowledge to construct a new interpretation that will guide future actions. The process involves “critical reflection of assumptions, validating contested beliefs through discourse, taking action on one’s reflective insights, and critically assessing it” (p. 11).
For Mezirow, adult learning is the direct result of critical discourse that challenges existing assumptions. He proposes the emphasis should be on creating an environment for adult learners that challenges existing beliefs. This environment should be one in which adults can learn from each other and in which the educator is a facilitator and a co-learner rather than the authority. The goal is to help the adult learner to become a more autonomous thinker by learning to evaluate meanings and purposes. In order for this to occur, however, educational interventions are required to ensure that the learner possesses the understandings, skills, and disposition needed for transformational learning.

“Critical reflection, awareness of frames of reference, and participation in discourse become significant elements in defining learning needs, setting educational objectives, designing materials and methods, and in evaluating learner growth” (Mezirow, 1997, p. 11).

In the context of E-learning in general and Web-based training in particularly, these theories of adult learning serve as critical factors in both the selection and the deployment of online learning environments. The needs of adult learners proposed by Knowles, whether as theory or as good teaching practice, are able to be met in online environments where users are allowed to choose the time, place, content, and duration of their learning experiences and can effectively tailor their learning to their individual needs and interests. Mezirow emphasizes that basic understandings and skills must be in place so that transformational learning can occur. In the case of instructional technology, the move to classroom technology integration might be considered the transformational element as this represents a challenge to the traditional assumptions about the pedagogy and methodology of teaching. However, for this transformation to occur, teachers must
possess basic skills and understandings; it seems possible that these can be facilitated through the use of carefully supported Web-based training.

Cercone (2008) predicts that online learning will continue to grow in importance to adult learners. She stresses that the needs of adult learners, with their own histories and their own requirements for self-direction, represent distinct challenges to those designing or evaluating online learning environments. Professional development is the support mechanism that should cater to the needs of the nation’s teachers. As digital tools continue to develop and become available for enhancing E-learning, it is important that designers and providers of professional development embrace these options in order to provide efficient and effective choices for educators.

Discussion

Summary and Interpretations

After a comprehensive review of professional literature on E-learning, Mayes and de Freitas (2004) concluded “there are really no models of E-learning per se—only e-enhancements of models of learning” (p. 4). They propose that online learning will reflect theories, frameworks, and models that already exist and will require only slight modifications for a digital environment. Further, they suggest that since the goal of online learning is to allow remote learners to learn as favorably as those in a face-to-face situation, these modifications are pragmatic rather than pedagogic. For this reason, well-designed Web-based training models can be expected to employ traditional pedagogies based on traditional theories about learners and learning (2004).

This is an interesting and somewhat controversial thought, but one that is supported by much of the research presented in this study. If the primary advantages to
Web-based training in particular and E-learning in general lie in the ability to customize time, place, content, and duration of the learning process, the traditional frameworks upon which knowledge about learning and learners has been built should remain relatively unchanged, even in a new environment. However, there is a need for continuing research and critical discussion to determine specific elements of E-learning that perhaps alter the role of the learner, that suggest changes in the delivery pedagogies, or that provide insight into the role that perceptions play in the acceptance of online learning.

Recommendations

Clarke (2002) reminds decision-makers that in order for technology to improve learning, “it must ‘fit’ into [users’] lives . . . not the other way around” (p. 1). Recent advances in technology-mediated instruction and Internet connectivity have served to strengthen the medium for providing asynchronous online learning. In particular, innovations in Web-based training include the development of learning management systems, the ability to customize learning through prescriptive pre-testing, and the addition of interactivity to tutorial-style lessons. However, while business and industry have made steady progress in the research and deployment of computer- and Web-based training, these systems are largely unexamined for the use of professional development in education. This gap suggests the need for empirical studies aimed at determining the viability of using Web-based training as part of a professional development plan for teachers.

Whether the professional development is designed to target curriculum content or technology skills, there must be a way to gauge the content quality and content flexibility
of the professional development experience offered through Web-based training, as well as the effect of teacher beliefs on their use of technology. Conditions appear to be in place for successful integration of technology into American classrooms, yet there is still surprisingly little high-level technology use despite teachers’ ready access to technology (Ertmer, 2005). Barriers to teacher acceptance of technology exist, and these include teacher beliefs and concerns about their own abilities to use technology successfully—for their own use and with their students. However, while Ertmer considers teacher pedagogical beliefs to be the final hurdle to achieving technology integration, there are those who disagree. Critical analysis of this proposition, together with an examination of the predictive value of teacher beliefs when compared to teacher knowledge, would greatly inform the field and be particularly beneficial to school districts seeking best practices for encouraging technology integration.

Online professional development seems to require the same effective practices that face-to-face delivery requires, and many studies have been done that indicate no significant difference between instruction delivered online and face-to-face (Shachar & Neumann, 2003). However, it is worrisome to witness the acceptance of technology-mediated professional development as an appropriate method for the teaching of technology skills without clear empirical evidence to support its effectiveness. Research should not be limited to quantitative studies, but should instead include qualitative measures in order to provide a more complete picture of the experiences and perceptions of participants. An examination of these issues may produce new theoretical models that will offer evidence that the asynchronous nature of E-learning has produced more than a simple enhancement to traditional frameworks.
The selection of E-learning from the shelves of the educational superstore seems to embrace a trend birthed by today’s almost ubiquitous access to the rich educational and social content available through the World Wide Web. As districts continue to shop for the professional development products that will deliver effective content in an efficient manner, the options for customization of time, place, content, and duration of learning offered by Web-based training remain enticing but unproven. For this reason, it is imperative that research is done that seeks a clearer understanding of the true effectiveness of this product and its potential for enhancing the technology skills of teachers.
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