The purpose of this paper is to describe the role of computer and information technology in scaling up research-validated instructional strategies like ClassWide Peer Tutoring (CWPT). Recently, implementation software, the CWPT Learning Management System, web and e-mail communications, and interactive multimedia resources have been developed to support teachers’ and schools’ use of CWPT. Preliminary findings suggest that this technology improves access and use of CWPT, and that when local school factors of implementation are in place, improvement in student academic scores replicate past CWPT results. Results suggest that the initial and ongoing professional development, the strength of local school leadership, and a building faculty’s ability to work with information technology are key elements to widespread implementation and accelerated student learning. The implications of such are discussed.
Among its various provisions, the “No Child Left Behind Act” (NCLB) (U.S. Department of Education, 2002) requires that schools employ instructional practices supported by rigorous evaluations of effectiveness and the NCLB provides consequences for schools whose students fail to achieve these standards. As a result, a move toward large-scale implementation of research-validated instructional practices has become of heightened interest for many school districts. Large-scale implementation, however, is not easily accomplished. Elmore (1996) envisioned four main components for large-scale program implementation:

1. create strong professional development structures that include an external system of evaluation of good teaching practice,
2. create organizational structures small enough to intensify and focus on systematic change,
3. establish an intentional process for reproducing large-scale change, and
4. establish structures that promote the learning of new practices and incentive systems that support them.

Professional development (PD) questions then arise regarding how to create these strong organizational structures to promote teacher access, learning, and the implementation of research-validated strategies. How is an effective practice best taught to teachers? How is it best migrated to and replicated by others at reasonable cost? How can PD be made to support and motivate classroom- and school-wide implementation? The most advanced PD methods for this purpose have included partnerships between schools and university researchers or the creation of a school-district system of teachers as researchers, responsible for translating research-validated strategies into local practice (Boudah et al., 2001). PD forms like these may or may not be available due to costs and because the developers of research-validated practices have not sought to promote use of their practice beyond initial research studies (Greenwood & Abbott, 2001).

However, the use of computer and information technology (CIT) could be an efficient way to increase awareness, access, and implementation support either alone or as a hybrid with PD models. CIT overcomes the need for an increasingly larger staff required to provide PD in different locations for an increasingly large population.
of users. CIT also addresses the difficulty of accessing information for
decision making and the materials and tools needed for PD and
guiding implementation. The purpose of this paper is to describe the
use of CIT as an integral component in implementing the long-distance
use of the Class Wide Peer Tutoring—Learning Management System
(CWPT—LMS) (Greenwood et al., 2001b) in schools.

BACKGROUND

CWPT is a reciprocal, peer-mediated instructional strategy in which
members of the same classroom tutor one another using the regular
classroom curriculum. Unlike teacher-mediated instruction, CWPT
makes it possible for students to experience one-on-one, pupil–tutor
dyads, relatively immediate error correction, and fast-paced instruc-
tion with multiple opportunities to respond. Students experience both
the teacher and learner roles in a classroom, with students with dis-
abilities included for instruction, simultaneously providing opportu-
nities for peer social interaction (Delquadri et al., 1986; Mortweet
et al., 1999; Sideridis et al., 1997; Utley et al., 1997).

CWPT is supported by more than two decades of experimental
research (Greenwood, 1997; Greenwood et al., 2002). Effect sizes
across a number of randomized trials using CWPT have consistently
fallen in the “medium” to “large” range (i.e., 0.3 to 0.8 ES; Cohen,
1988) on indicators of achievement and improvement in classroom
engagement and social behavior (see Table 1). One twelve-year longi-
tudinal study demonstrated that students who used CWPT experi-
enced significantly higher growth in grades 1 to 4 (Greenwood
et al., 2001b); continued higher growth in achievement into middle
school, with fewer special education services (LD, EMR, BD,
Conduct Disorders, ADHD) (Greenwood et al., 1993c); and produced
significantly fewer students who dropped out of school prior to gradu-
ation from high school (Greenwood & Delquadri, 1995). Other forms
of CWPT, such as Peer Assisted Learning Strategies (PALS) based on
CWPT procedures, have proven similarly effective in younger and
older students with and without disabilities (see Table 1).

In summary, CWPT is a research-validated strategy that acceler-
ates the academic outcomes of students with a wide range of abilities.
Further, findings have established that when teacher fidelity is
improved using feedback and consultation, so too is student learning
(Arreaga-Mayer, 1998; Delquadri et al., 1990; Greenwood et al.,
1992). However, if CWPT is to be widely adopted by large numbers
of schools/districts in the country, PD issues of long-distance training
and teacher fidelity must be addressed.
<table>
<thead>
<tr>
<th>Citation</th>
<th>Description</th>
<th>Indicator</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenwood, Delquadri, &amp; Hall (1989)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Prospective, longitudinal, randomized CWPT trial, 1st–4th grades (N = 416)</td>
<td>Reading achievement</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Language achievement</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arithmetic achievement</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Academic engagement</td>
<td>1.41</td>
</tr>
<tr>
<td>Greenwood (1991)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Multiyear behavioral trajectories, 1st–3rd grades (N = 115)</td>
<td>Academic engagement</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task management</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inappropriate behavior</td>
<td>0.83</td>
</tr>
<tr>
<td>Greenwood et al. (1993c)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Follow-up at seventh grade (N = 303)</td>
<td>Reading achievement</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Language achievement</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arithmetic achievement</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social studies achievement</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Science achievement</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduction in SPED services</td>
<td>0.54&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less restrictiveness services</td>
<td>0.73&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Greenwood &amp; Delquadri (1995)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Follow-up at twelfth grade (N = 231)</td>
<td>Reduction in school dropout</td>
<td>0.66&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mathes, Howard, Allen, &amp; Fuchs (1998) (N = 96)</td>
<td>Randomized PALS trial, grade K</td>
<td>Woodcock word ID</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Woodcock word attack</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Woodcock comprehension</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CBM (low achievers)</td>
<td>0.03–1.35</td>
</tr>
<tr>
<td>Fuchs, Fuchs, Thompson et al. (2001) (N = 379)</td>
<td>Randomized PALS trial, grade K</td>
<td>Segmentation, blending</td>
<td>0.45–2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alphabets</td>
<td>0.02–1.96</td>
</tr>
<tr>
<td>Fuchs, Fuchs, Phillips, et al. (1995) (N = 120)</td>
<td>Randomized PALS trial, grades 2–4</td>
<td>Math achievement</td>
<td>0.34</td>
</tr>
<tr>
<td>Fuchs, Fuchs, Mathes, &amp; Simmons (1997) (N = 120)</td>
<td>Randomized PALS trial, grades 2–6</td>
<td>Reading achievement</td>
<td>0.22–0.56</td>
</tr>
</tbody>
</table>

*Note.* Effects sizes are Cohen’s *d*; *w* = effect size calculated from chi-square as *w*.

<sup>1</sup>These peer-reviewed publications report the longitudinal achievement, behavior and life event effects of a single CWPT trial.
THE USE OF COMPUTER AND INFORMATION TECHNOLOGY (CIT) WITH CWPT

To address these issues, subsequent work led to a computer-assisted learning management system. The CWPT Learning Management System (CWPT—LMS) is a software application that provides teachers with a convenient way to create and deliver peer-tutored content, monitor student participation, and assess student performance and progress.

In an early project, an interactive multimedia CD was developed that contains text, photos, and video illustrations of CWPT that could be viewed any time at a teacher’s convenience (Greenwood et al., 1993a). A second effort assembled experts’ knowledge about CWPT implementation problems and solutions and created a “rules-based advisor” system for teachers. Based on student progress, the weekly advisor component provided suggestions for improving CWPT implementation (Greenwood et al., 1993b). For example, the program advises the teacher when the tutoring material may be too difficult or too easy.

Finally, to promote high quality implementation, an electronic record-keeping system was developed to help teachers manage CWPT data (Greenwood et al., 2001a). The system also permitted teachers to randomly or manually form weekly peer-tutoring partners and teams, time the duration of daily tutoring sessions, enter tutoring point scores, and record weekly pre–post scores of mastery or fluency in the actual sequence of real-time classroom implementation of CWPT. Other tools in the system allowed teachers to easily produce graphs of student and group progress and use this information to make instructional decisions. These graphs were also used as reports for parents during parent–teacher conferences (see Fig. 1). These CIT components were joined with the previously developed CWPT instruction technologies to form the CWPT—LMS. During the process of revising and creating CIT materials, an advisory board of teachers, administrators, parents, and research staff involved in former CWPT projects reviewed materials and made suggestions. Improvements were made based on advisory board suggestions.

A BLUEPRINT FOR REACHING SCALE WITH FIDELITY

The CWPT—LMS program was only part of what was needed to prepare for large-scale implementation. Also needed was a plan or blueprint for reaching scale. Fig. 2 shows the finalized CWPT—LMS
blueprint that has four components: core, support, replication, and information technology. **Core components** are procedures focused on designing and integrating CWPT into classroom instructional applications (e.g., second grade spelling) to yield a comprehensive curriculum. This component contains information about skills to be taught and the unique peer-mediated aspects of CWPT that

![Graph of mean class spelling accuracy over weeks for one teacher with high implementation fidelity.](image)

**Figure 1.** CWPT—LMS graph of mean class spelling accuracy over weeks for one teacher with high implementation fidelity.

<table>
<thead>
<tr>
<th>Core Components</th>
<th>Support Components</th>
<th>Replication Components</th>
<th>Information Technology Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWPT Process</td>
<td>Adoption Process</td>
<td>Public Awareness Campaign</td>
<td>E-mail</td>
</tr>
<tr>
<td>Teacher Manual</td>
<td>Process</td>
<td>Site Recruitment</td>
<td>Web</td>
</tr>
<tr>
<td>Curriculum Procedures</td>
<td>Staffing Process</td>
<td>Leadership Training</td>
<td>Downloads</td>
</tr>
<tr>
<td>Student Progress</td>
<td>Software/Multimedia/Materials</td>
<td>Published Materials</td>
<td>Web Services</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Trainer of Trainers</td>
<td>Materials/Media</td>
<td>Online Documents</td>
</tr>
<tr>
<td>Weekly Advice</td>
<td></td>
<td></td>
<td>Centralized Web</td>
</tr>
</tbody>
</table>

**Figure 2.** CWPT—LMS scaling up blueprint.
complement conventional, teacher-led instruction (e.g., Elmore, 1996; Utley et al., 1997).

Support components are products and tools that make CWPT usable by classroom teachers. For example, the CWPT—LMS includes information on the peer-tutoring process, curricula, student progress monitoring, and computer-assisted analysis of implementation. These tools support and guide weekly planning, daily implementation, and instructional decision-making to improve individual and group learning in CWPT (e.g., Carnine, 1997).

Replication components are procedures that support migrating CWPT to diverse, new, local school programs using a trainer-of-trainer model (see Fig. 3). At the top of this model is a national or state consultant (NSC), a person with the ability to recruit and involve schools. The consultant recruits at least two schools for involvement by working with local schools and by recruiting a site coordinator (SC) to act as the lead trainer and coordinator of CWPT—LMS implementation. The SC works directly with a building facilitator or principal, who in turn works with teachers, who in turn work with students and parents. These components involve elements of marketing and public awareness (see, for example, http://www.kansaskidshealth.org/archived_detail.asp?ProgramID = 4), combined with leadership training and professional development (e.g., annual CWPT Training Institutes) in an effort to identify and recruit new sites.

As in other professions, the model of competing in a marketplace, “supply and demand” environment has become a reality

---

**Figure 3. Trainer-of-trainers model.**

<table>
<thead>
<tr>
<th>National Consultant</th>
<th>- Recruits Local Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Coordinator</td>
<td>-Trains Local Participants</td>
</tr>
<tr>
<td>Principal</td>
<td>-Monitors Progress/Fidelity</td>
</tr>
<tr>
<td>Teachers</td>
<td>-Implements CWPT-LMS</td>
</tr>
<tr>
<td>Students</td>
<td>-Engage in CWPT</td>
</tr>
<tr>
<td>Parents</td>
<td>-Receive Progress Reports</td>
</tr>
</tbody>
</table>
in educational large-scale replication efforts. The CWPT—LMS blueprint fits this model. On the supply side, the CWPT—LMS blueprint is an effort to increase the supply of products and practices based on rigorous empirical evidence. On the demand side, federal policies and regulations (e.g., No Child Left Behind Act of 2002) have boosted the “market value” of evidence-based practices. These mandates and policies contain economic consequences for failing schools and provide incentives for use of effective practices.

Gladwell (2000) argued that in a market economy, the spread of social phenomena, like fads, can be explained by the concepts of epidemic and contagiousness. According to Gladwell, “exposing people to phenomena infects them so that they will do the same as others” (p. 6), and “small individual changes eventually lead to large group effects.” The tipping point, he argued, is where “an idea, trend, or social behavior crosses the threshold, tips, and spreads like wild fire.” Market forces with powerful implications for reaching scale are addressed in the CWPT—LMS blueprint. Computer and information technology play a key role in this scaling-up plan.

Computer and information technology (CIT) components support world-wide electronic communications and immediate access to CWPT—LMS information (e.g., web site, document information, procedures, e-mail, and databases). Teachers can install the two-CD CWPT—LMS set on any classroom desktop computer and link in a number of ways to a set of CWPT resources. In the Help menu, teachers can access an electronic copy of the CWPT—LMS teacher’s manual, the CWPT—LMS web site, or the Interactive multimedia CD among other tools (see Fig. 4). For example, from the web site links below, teachers can take a CWPT—LMS tour or engage in tutorials showing how it works:


CIT components make CWPT readily accessible to teachers and administrators. CIT also establishes a central database for the receipt of individual student progress and other valuable indicators (e.g., school and teacher implementation) that are of interest to program evaluation and empirical research on scaling up. The computer and
information technology offered within the CWPT—LMS has the potential to aid in streamlining PD because it can facilitate faster access, provide efficient communication, support individual implementation, assist data collection and analysis, and provide problem solving advice.

For example, e-mail and the Internet create speedy communication among various project participants within and across sites, negating barriers of geography. Personal CWPT software for teachers supports weekly planning and daily implementation. Adapting CWPT instruction to fit group and individual learner needs becomes faster and more accurate because students’ learning results are captured in software or web forms and displayed immediately for use in decision making. Weekly progress data may also be transported over the web directly to a centralized database for centralized analysis, evaluation, and research on scaling up (Bullock & Ory, 2000).

In the current project, we have tested the CWPT—LMS program in a two-year implementation study. Below, we address the following research questions based on the first year’s implementation effort.

1. What was the level of successful CWPT—LMS implementation and research participation, and what local contexts appeared to moderate it?
2. Where implementation was “on protocol,” what spelling outcomes were achieved by students?

**METHOD**

**Participants**

Using the steps enumerated in the replication components (see Fig. 3), we recruited Consultants (NSCs) by contacting a list of CWPT-experienced faculty around the country, posting an announcement on the Council for Exceptional Children’s website, conducting presentations, and disseminating by word of mouth. Four NSCs recruited one or two site coordinators (SCs) and five implementation schools in four states. SCs were a mix of principals, graduate students, and teachers willing to assume this role (Abbott et al., 2003).

Schools and teachers agreeing to participate committed themselves to having Internet access in each classroom with a computer to run the LMS software, providing time for professional development, implementing the CWPT—LMS in spelling or reading, transmitting data back to researchers electronically, and including at least one student with a disability in every classroom. Participating K–5 elementary schools ranged from 14 to 73 teachers, with student populations ranging from 160 to 745. Schools were public and private/parochial located in urban cities in Florida and Maryland and rural settings in Nebraska and Mississippi. The researchers/developers were located in Kansas City.

In summary, we sought to draw together our past experiences implementing research-validated practices in schools (Abbott et al., 1999) and Elmore’s ideas concerning a strong PD structure. This structure included an external teacher system of evaluation within local organizational structures small enough to intensify and focus on systematic change using the trainer-of-trainer model (see Fig. 4). In this approach, the NSC supported the SC, who established teacher access to and use of the CWPT—LMS and who trained and supported building personnel and monitored their progress.

**Training National Site Consultants (NSC) and Site Coordinators (SC)**

In prior CWPT projects, the researchers/developers had provided teacher training and used onsite implementation visits, direct teacher consultation, and observational data collection. In this project, the NSC, SC, and local school staff took over these duties in the context of the CWPT—LMS blueprint. The researchers assisted the NSC and
SC by phone and email, but had limited problem-solving contacts with teachers or local tech staff. The training of district personnel on how to train local teachers became paramount to successful large-scale implementation.

We conducted a three-day leadership institute in Kansas City to prepare NSCs and SCs with the skills, media, and materials needed to implement the CWPT—LMS at their locality. The training taught participants how to implement CWPT, use the CWPT—LMS program, recruit teachers, negotiate contracts with local schools, deliver technical assistance, and monitor, report, and evaluate site progress.

Prior to attending the Summer Institute, participants received a copy of the CWPT—LMS software and resource CDs. Participants were asked to install the software on a laptop computer and complete a short LMS assignment. In the institute, we trained the participants using the same instructional format that we wanted them to use in fall teacher in-services. The first two morning sessions included a PowerPoint presentation covering relevant content. Afternoon sessions were spent engaged in hands-on computer applications of the morning’s lessons. The last day included a conversation about administrative and research issues.

We created two PowerPoint presentations, organized according to key statements concerning CWPT. Key principles were supported by a detailed explanation of important information to convey during teacher training. Additionally, a web simulation CD was created that allowed participants to view most components of the website without having an Internet connection. Information about accessing web forms and data transmission was covered.

**Teachers’ Training, Software, and Materials**

Teachers’ implementation materials included the CWPT—LMS two-CD set, containing the LMS software and the multimedia resource CD. The resource CD provided supplementary instruction and training that a teacher or any person interested in the CWPT—LMS program could access anytime. The supplementary resource CD included the CWPT manual (see Fig. 2), the CWPT—LMS Gallery of illustrative videos and pictures detailing procedures of the CWPT—LMS program, and a tutorial that navigated through the major LMS components. The tutorial began with how to launch CWPT—LMS and continued through the creation of a class roster, data entry, graphs creation, accessing the Advisor system, and finally the FTP procedure for data transmission. These training and resource materials provided a layering of information from initial training through PD to improve existing practice. Upon returning
to their localities, each consultant–coordinator team prepared a schedule for implementing teacher training and CWPT—LMS implementation across the 2000–01 school year.

**CWPT—LMS Implementation**

We used five criteria to determine the level of each teacher’s implementation of the CWPT—LMS. Implementation was measured as the percentage of registered teachers at each school who had completed:

1. registration at the website, thereby transmitting a confirmatory web form
2. administration and transmission of target student CBM assessments
3. implementation of the CWPT instructional process
4. CWPT—LMS setup, use, and transmission of weekly student progress data
5. fidelity of implementation checklists returned for each teacher.

These five tasks could have been initially completed as early as October, but in most cases took longer to complete.

**Measures of Student Progress in the Spelling Curriculum**

Classroom teachers collected weekly pre- and post-test measures of student progress in the spelling curriculum and analyzed these data using the CWPT—LMS program. Teachers created, administered, and graded a test of spelling words tutored each week and created a set of words to be tutored in the upcoming week (Greenwood & Hou, 2001). Teachers entered the data into the CWPT—LMS and transmitted them each Friday via the Internet for storage in the central database.

**RESULTS**

**What Was the Level of Implementation?**

Results indicated that 57% of participating teachers implemented all five key tasks (see Table 2). In Schools 1 and 2, 100% of teachers implemented all tasks. In Schools 3 and 4, 45% and 42% of teachers implemented all five tasks, respectively. No implementation occurred in School 5. Across the five individual implementation, implementation ranged from 80% to 40%. Eighty percent of the teachers registered (Task 1), 70% completed CBM evaluations (Task 2), and 60%
conducted CWPT (Task 3). Tasks 4 and 5 were completed least often, 42% for Task 4 (implemented the CWPT—LMS) and 40% for Task 5 (completed teacher fidelity checks).

Successful implementation hinged on three key factors: support of administration, fall training, and the ability to overcome technology challenges. Schools 1 and 2 (full implementation) both had administrators who strongly supported the program, provided at least adequate fall teacher training, and worked closely with project staff to overcome any technology challenges. School 3 (low implementation) had good administrative support but poor training and technology problem-solving abilities. In School 4 (low implementation), the training was sufficient, but administrative and technology support was weak. Low teacher implementation occurred. School 5 (no implementation) had low administrative support, no training, and no technology problem-solving abilities.

Students’ Spelling Outcomes for Those Teachers Who Implemented CWPT-LMS

This next analysis was based on seventeen teachers reporting spelling data for a total of 337 students who collectively contributed 4,369 weekly CWPT data records. Weekly mean trends showed variation in pretest spelling accuracy ranging from 1 to 32 weeks ($M = 10.3$ weeks) of CWPT.
CWPT substantially impacted weekly post-test spelling accuracy. Pretest scores were in the 40–50% range, but all classroom groups increased to within the 80–100% range, with minor exception. Overall, the pretest mean calculated at Week 7 was 47.2% correct (pretest slope over weeks = 0.16% correct), increasing to a mean of 93.4% correct (post-test slope over weeks = −0.02%) following a week of CWPT. The overall mean gain was 47.2% correct (slope over weeks = −0.21%). The increasing pretest linear slope (0.16% per week) indicated that the pretest words became easier; also evident was a slightly decreasing trend in weekly mean gain (−0.21%).

**DISCUSSION**

Results indicated that when the use of CWPT—LMS was ‘on protocol’ in local schools—with local SC training and monitoring and teacher implementation—students’ weekly spelling accuracy gains were consistently large, replicating prior research (e.g., Greenwood et al., 2001a). Results also confirmed that scalability success requires tools and expertise in areas beyond just a proven, research-validated strategy. Specifically, we found that the factors described by Elmore (1996), including a strong PD structure (Summer Institute, fall teacher training, ongoing PD), an organization small enough to focus on systematic change (trained SCs training local teachers), an intentional process for reproducing the change (CWPT—LMS blueprint), and an incentive system that supports change (improved student achievement), were all essential in successful implementation.

How is an effective practice best taught to teachers on a large-scale basis? First year results clearly illustrated the critical role that local school leadership played in training teachers to implement the CWPT—LMS program. Reaching scale requires local school leaders to set the expectation of full implementation, ensure sufficient training, and monitor the daily details of implementation. Findings favored having a school administrator take responsibility to ensure that both training and implementation occurred “on protocol.” In the most successful schools, PD continued throughout the year in the form of individual consultation and mentoring as needed.

How are research-validated strategies and programs more easily replicated at reasonable cost using technology? In a PD model of trainers (see Fig. 2), training local school administration staff to train teachers, initial training that emphasized computer and information technology (CIT), strongly enhanced successful implementation. CIT required relatively little local staff to conduct in-services,
consult, observe, and problem solve with teachers. Findings also supported the detailed involvement of the local individual responsible for and capable of serving and maintaining the local school’s technology systems and negotiating the local networks infrastructure.

Resolving CIT challenges with ongoing PD were also important. During training and throughout the school year, the quick resolution of technology issues was crucial to establishing and sustaining successful implementation. For example, for School 1’s fall training, the administrator planned to demonstrate the CWPT—LMS software on an older, school-centralized computer that could not correctly load the software. Fortunately, the administrator communicated with the CWPT—LMS project programmer several days before the actual training. The programmer provided the needed programming patch to fix the problem before the fall training, and CWPT—LMS was quickly implemented in early fall. Even though the multimedia resources were valuable training tools for individualized PD, some teachers reported occasional hardware problems on individual computers. To resolve this and other local computer specific challenges, we compiled a troubleshooting list of potential challenges and fixes and incorporated this information into the web site and future training.

The technology expertise of teachers at the local level cannot be underestimated. Pope and Golub (2000) reported that technology-experienced teachers who also knew how to use software applications in their teaching managed to create beneficial learning environments for their students. Similarly, in the CWPT—LMS program, teachers experienced in using spreadsheets, word processing software, and other communication software easily generalized to using the CWPT—LMS. Teachers without CIT background knowledge required additional training and support, and in some cases, even this was not enough for them to succeed. The time for this additional training was often difficult to work into school schedules, and the lack of teacher and administrator expertise affected implementation (Buzhardt et al., in press).

How can PD be made to support and motivate classroom- and school-wide implementation? Initial results confirm prior research, that widescale implementation within a school district begins at the highest district levels. In school districts where strong administrative support began at the district level and continued down to the local school administrative level, strong implementation occurred. In areas with weak district support, implementation was non-existent or less successful. For example, at the beginning of the project, School 3 administrator strongly supported program implementation and facilitated good training efforts. It was first thought that implementation
was proceeding slowly because of technical difficulties. However, once those issues were resolved, implementation continued to stagnate. We later learned that, although the CWPT—LMS program fit within the philosophy of the school district, strict implementation of the new mandated reading program took first priority. With ongoing scheduling and training conflicts, the administrator was unable to provide the needed support for complete CWPT—LMS program implementation. Thus, only 25% of the teachers included CWPT instruction, and none of the teachers incorporated the LMS software portion of the program.

Improving the scalability of CWPT at a low cost using CIT tools has not been easy, but first year results show its feasibility. Classroom implementation occurred in four of five implementation schools, and student achievement in these schools was comparable to past CWPT studies. Our experiences with two decades of CWPT implementation suggest that this degree of scaling up success at these costs could not be possible without use of CIT. Our blueprint for scaling up the CWPT—LMS program fits well within Elmore’s vision for large-scale implementation of strong professional development structures that are locally controlled to create sufficient intensity to ensure systematic change. Our belief is that technology enhances that blueprint because it facilitates the process for reproducing systematic change and creates the incentive of academic student improvement to maintain implementation.

REFERENCES


measure of the rate of implementation. *Journal Educational Technology Research and Development.*


Copyright of Reading & Writing Quarterly is the property of Routledge, Ltd.. The copyright in an individual article may be maintained by the author in certain cases. Content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.