

Scaling up ClassWide Peer Tutoring: Investigating Barriers to Wide-Scale Implementation from a Distance

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Effectively scaling up evidence-based educational practices requires identification of barriers to the wide-scale implementation and maintenance of such practices at a distance from the original research and development team. The two studies reported here investigated the implementation of ClassWide Peer Tutoring (CWPT) in nine schools across five states. In Study 1, implementation was measured in terms of the percentage of teachers who completed the tasks required to conduct CWPT and the research protocol. Factors were identified that may have contributed to implementation variability across schools. In Study 2 we used "rate of implementation" as the implementation measure in an effort to assess the degree to which the factors identified in Study 1 affected implementation across a larger group of schools. Barriers were classified as Strong, Weak, or Non-Barriers. Implementation barriers included limited communication between practitioners and research staff, lack of support for CWPT from school and/or district leaders, and unexpected changes in school administrative responsibilities or staffing. Strategies for overcoming these barriers and the need for additional implementation research are discussed.

Key Words: Scalability, Peer Tutoring, Progress Monitoring, Educational Technology

The gap between what practices we know work and their spread to a large number of schools is well known (e.g., Carnine, 1997; Elmore, 1996; Greenwood & Abbott, 2001; Klingner, Ahwee, Pilonieta, & Menendez, 2003). Barriers to wide-scale implementation or "spread" of evidence-based practices have been identified as including the following: (a) lack of practices that are "usable" under a variety of classroom conditions, (b) limited access to effective practices, (c) lack of time and resources to integrate new practices, (d) disconnect between research and school communities, and (e) lack of administrative support. Although these variables may function as barriers in a general sense, each evidence-based practice also has a unique set of barriers depending on a range of factors, such as target population, effectiveness of the asso-

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Table 1

Methodologically Rigorous Evidence (Randomized Trials) Supporting the Efficacy of CWPT

Citation	Description	Indicator	Effect Size
1. Greenwood, Delquadri, & Hall (1989)	Prospective, Longitudinal	Reading Achievement	0.57
(*Note.* These four peer-reviewed publications	Randomized CWPT trial,	Language Achievement	0.60
report the longitudinal achievement, behavior	1st-4th Grades (*N* = 416)	Arithmetic Achievement	0.37
and life event effects of a single CWPT trial)		Academic Engagement	
	Multi-Year Behavioral Trajectories,	Academic Engagement	0.63
	1st-3rd Grades (*N* = 115)	Task Management	0.61
		Inappropriate Behavior	0.83
3. Greenwood et al. (1993)	Follow-up at 7th Grade	Reading Achievement	0.39
	(*N* = 303)	Language Achievement	0.35
		Arithmetic Achievement	0.57
		Social Studies Achievement	0.39
		Science Achievement	0.48
		Reduction in SPED Services	0.54*
		Less Restrictiveness Services	0.73*
4. Greenwood, & Delquadri (1995)	Follow-up at 12th Grade (N = 231)	Reduction in School Dropout	0.66*
Mathes, Howard, Allen, & Fuchs (1998) (*N* = 96)	Randomized PALS Trial, Grade 1	Woodcock Word ID	0.70
		Woodcock Word Attack	0.78
		Woodcock Comprehension	0.27
		CBM (Low Achievers)	.03-1.35
Fuchs et al. (2002) (*N* = 379)	Randomized PALS Trial, Grade K	Segmentation, Blending	0.45-2.1
		Alphabetics	0.02 -1.96
Fuchs et al. (1995) (*N* = 120)	Randomized PALS Trial, 2-4 Grades	Math Achievement	0.34
Fuchs, Fuchs, Mathes & Simmons (1997) (N = 120)	Randomized PALS Trial, 2-6 Grades	Reading Achievement	0.22-0.56

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

ciated professional development materials and procedures, degree of technology integration, and support available to adopters.

This article describes the authors' efforts to (a) identify the barriers to scaling up ClassWide Peer Tutoring (CWPT), (b) measure the degree to which these barriers limit implementation across multiple sites, and (c) identify conditions that affect the impact of these barriers on implementation. This work was comprised of two multi-site studies in which implementation occurred at a distance from the research staff and developers. In the first study, five schools across four states implemented CWPT, and implementation was measured in terms of percentage of implementation tasks completed across schools and teachers. In the second study, nine schools across five states implemented CWPT, and implementation was measured in terms of percentage of implementation tasks completed and the rate at which schools completed them.

What Is CWPT?

CWPT is an instructional procedure with 20 years and over 35 studies to support its effectiveness in a variety of content areas for students with mild developmental disabilities, including a wide range of SES's and cultural backgrounds. Table 1 summarizes four publications that report the results of a randomized longitudinal study of the use of CWPT across diverse settings.

The key to CWPT's effectiveness is maintaining active student responding and motivation while providing teachers with continuous student outcome data for progress monitoring. In CWPT, pairs of students complete activities that require overt responses from one student (the tutee), while the other (the tutor) provides immediate, corrective feedback. After the tutee completes the activity, students reverse their roles and complete the activity again. During these activities, students record their progress (e.g., number of points for each tutoring session), resulting in a permanent product of their performance for teachers to use to gauge progress. The primary progress monitoring measure is students' weekly pre- to posttest performance. Students take a pretest at the beginning of each week, participate in at least three tutoring sessions during the week, and then take a posttest at the end of the week.

The tutoring points and scores on pre- and posttests provide a means for teachers to conduct continuous progress monitoring and make data-based instructional decisions. However, the process of managing, organizing, analyzing, and interpreting the data often proves to be too challenges without the assistance of a highly trained CWPT practitioner. In addition, implementation fidelity tends to fall below acceptable levels without continuous implementation monitoring by a trained teacher partner (Greenwood, Hou, Delquadri, Terry, & Arreaga-Meyer, 2001).

The solution to these issues has required the assistance of additional personnel either from a research team or the schools' own staff, making CWPT a costly strategy for schools to adopt. The ClassWide Peer Tutoring: Learning Management System (CWPT-LMS) software package was developed to reduce the CWPT workload (e.g., data management, development of CWPT materials, creating tutoring pairs), improve implementation fidelity, and help teachers interpret and use outcome data for progress monitoring (Greenwood et al., 2001).

The CWPT-LMS software is comprised of three primary components: Program Support, Progress Monitoring, and Data Management. Program Support provides tools for teachers to create a student roster; plan/assign weekly tutoring partners; enter and calculate student points from CWPT sessions; and view, print, and edit student pre- and posttest scores. The Progress Monitoring component allows teachers to view graphs of individual student or classwide pre- to posttest performance (see Figures 1 and 2). Using the Progress Monitoring tool, teachers can also access the CWPT Advisor, which identifies low-performing students, recommends strategies for improving class and/or individual student performance, as well as noting successes. Informed by class data, the Advisor uses class data (e.g., CWPT points, pre-posttest scores, frequency of CWPT sessions) to generate recommendations based on expected performance and strategies that are known to improve CWPT outcomes (Greenwood et al., 2001). For example, the Advisor provides weekly information about content difficulty (e.g., the teaching material is too easy if most students are scoring above 50% on the pretests); time devoted to CWPT (e.g., students are not participating in enough CWPT sessions if CWPT is occurring less than three times per week); and attendance (e.g., student X's low pre- to posttest gain may have been caused by her low participation in CWPT sessions that week). Finally, the Data Management component provides options for backing up and restoring data, removing classroom data, and sending data to researchers at Juniper Gardens Children's Project via the Internet.

What Is Scaling Up?

The essence of scaling up an educational practice is the ability to implement a practice across a large number of classrooms, schools, or districts. Other fields, such as the public health community, refer to "universal interventions" designed for large-scale implementation within an entire community or across several communities (Offord, Kraemer, Kazdin, Jensen, & Harrington, 1998; Spoth, Kavanagh, & Dishion, 2002; Spoth & Redmond, 2002). These interventions are "designed for" large-scale implementation, not merely implemented on a large scale without modifications to the original design. The barriers to scaling up interventions mirror those experienced for educational interventions. For instance, with reference to scaling up a research-based parent training program, Olds and his colleagues (2002) asserted that research-based programs "run the risk of being watered down in the process of being scaled-up" (p. 168). In other words, as use of a practice scales up beyond the developers' reach, the potential for procedural drift increases. Identifying factors that contribute to this "drift," lack of implementation, and/or a lack of sustainability, is critical to scaling up evidence-based educational practices (Klingner, 2004).

Research on scalability has a rich history. One of the earliest studies investigated the large-scale adoption of hybrid seed corn by Iowa farmers. Ryan and Gross (1943) tracked the rate of hybrid-seed corn use in two Iowa communities with 259 farmers. Based on farmers' self-reports, 10% used the corn during the first 5 years of the 13-year study, followed by a dramatic increase to 40% in the next 3 years, and then a leveling off over the next 5 years until all but two of the farmers had implemented the new corn. This research resulted in a flurry of studies (791 by 1981)

Figure 1. Graph generated by the Progress Monitoring component of the CWPT-LMS showing class average pre- to posttest performance across six weeks.

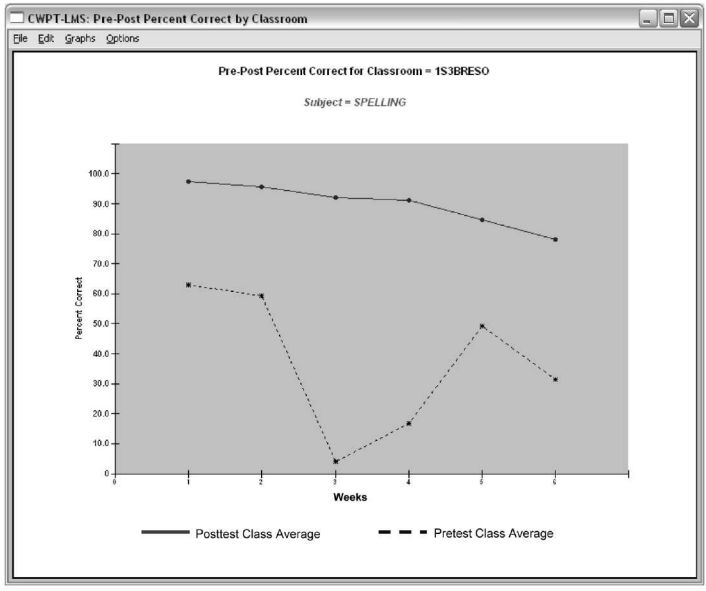
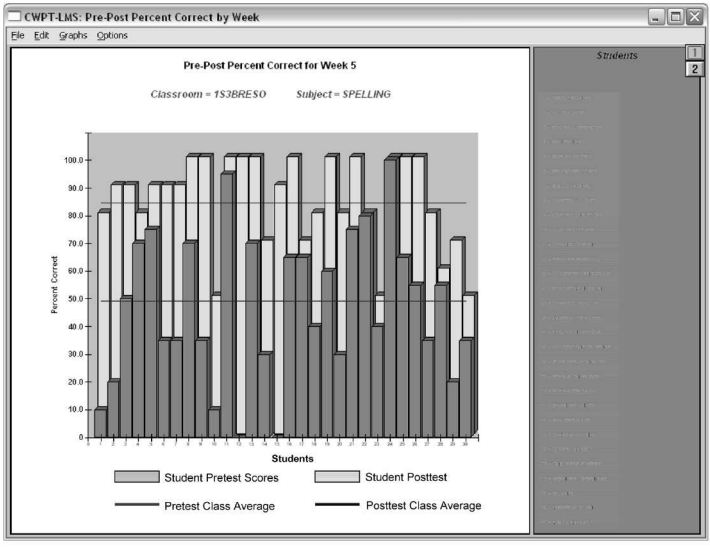


Figure 2. Progress Monitoring graph showing individual student pre- to posttest performance for a single week (dark bars are pretest scores, lighter bars are posttest scores).



within rural sociology on the spread of innovations (Rogers, 2003). In fact, Ryan and Gross's study was so influential that few researchers strayed from the use of self-report to measure implementation uptake. In the 1950s and '60s, this self-report methodology was used in studies of the scalability of educational innovations, such as kindergartens (Mort, 1953), modern math (Carlson, 1965), and driver's education courses (Allen, 1956, as cited in Rogers, 1995).

In more recent research, Klingner and her colleagues (2003) reported the results of their efforts to scale up four research-based educational practices across six schools. Their measures included how often teachers implemented the practices, the degree to which teachers modified the practices, teacher-reported barriers to implementation, and teacher-reported "facilitators" of implementation. Implementation (frequency and fidelity) was measured using a combination of researcher observations and teacher logs. Two of the most significant barriers to implementation were lack of instructional time and administrative support; facilitators of implementation, on the other hand, included a network of support from other teachers within the school and easily accessible materials and resources to support implementation. Klingner et al.'s study advanced the scaling-up literature in education by including a measure of the degree of implementation rather than a simple all-or-no-implementation measure. In addition, teachers' self-reports of implementation were supported by researcher observations.

McInerney and Hamilton (2007) investigated the large-scale implementation of scientifically based special education interventions in 32 school districts across a four-year period. The Elementary and Middle Schools Technical Assistance Center (EMSTAC) was used as a means to support school districts' identification, implementation, and maintenance of interventions to address the specific needs of their special education students. Each district received one of three types of technical assistance (TA) strategies to support their efforts. The three strategies varied in (a) how much compensation districts received for their implementation, (b) the type of training districts received (face-to-face or web-based distance training), and (c) the type of support districts received after initial training (site visits, or web-based discussion boards and videoconferencing). Based on "the relevant literature and expert judgment" (McInnerney & Hamilton, p. 249), an implementation scale score was derived from 27 tasks and activities essential to the adoption of scientifically based interventions. No statistically significant differences between implementation scale scores were found between strategies. However, implementation scale scores significantly increased from Year 1 to Year 2. Also, a significant positive correlation was found between scale scores and the amount of contacts between EMSTAC and districts during Years 1 and 2. The authors concluded that district-level support and communication, both between the district and EMSTAC and within districts about implementation, were crucial to successful implementation and maintenance of scientifically based interventions.

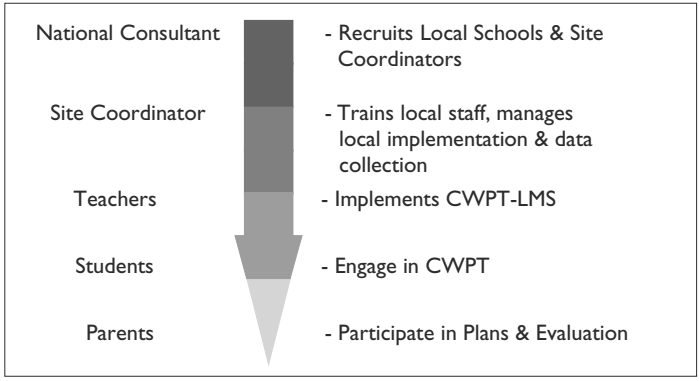
Background of the Current Studies

As part of a three-year OSEP-funded Steppingstones of Technology project, the two studies reported here focused on developing, refining, and testing our process for scaling up CWPT. Using a "blueprint" (see http://www.jgcp.ku.edu/CWPT-LMS/ProjectInfo/blueprint.htm) for replicating

and spreading the use of CWPT in geographically distant schools, we conducted a two-year study of CWPT implementation and its effectiveness in improving learning outcomes of children with and without disabilities in general education classrooms. Reported here are findings specific to CWPT implementation and the methods used to identify barriers to implementation from a distance.

CWPT implementation requires that local schools and/or school districts manage training, implementation monitoring, and, in our case, research protocol and data collection. The CWPT Administrative/Adoption model (Figure 3) shows how the management and coordination of these responsibilities trickles down from a National Consultant, who recruits schools to implement CWPT, to students' parents, who are major stakeholders in the effectiveness of CWPT. Perhaps the most important link in this model is the Site Coordinator (SC), who is usually a principal or other high-level building staff.

Figure 3. The administrative/adoption model for implementating the CWPT-LMS.



SCs and National Site Consultants (NSC) are trained at a three-day training workshop at Juniper Gardens in Kansas City, Kansas. At these workshops, SCs learn how to implement and manage CWPT in their schools, deliver and receive technical assistance, and monitor and evaluate CWPT-related school activities. The SC is then responsible for training local teachers in how to run CWPT in their classrooms, monitor fidelity of implementation, and send data to researchers. NSCs, in turn, learn how to negotiate contracts with local sites and use the Administrative/Adoption model to initiate and maintain local program implementation efforts.

Study 1

The primary focus of Study 1 was to identify potential barriers to CWPT implementation from a distance. (See Abbott, Greenwood, Buzhardt, & Tapia [2005] for additional details about this study.) This was the antecedent to a larger, more detailed analysis of the barriers to scaling up CWPT. In addition to identifying a pre-

liminary set of barriers for additional analysis in Study 2, this study helped us refine our procedures and troubleshoot technological problems with the software and website.

Methods

Participants

Participant recruitment began by signing on four NSCs, who were university faculty and had implemented CWPT with local schools in the past, usually for research purposes. Following the Administrative/Adoption model, the NSCs then recruited five SCs to oversee CWPT implementation in five schools across four states. The SCs consisted of one principal, one vice principal, two doctoral students, and one teacher, who had a prior or existing relationship with the school(s) in which they oversaw, but did not have prior experience with, CWPT. Each SC received a payment of $750 at the end of the year for his or her participation (Abbott, Buzhardt, & Greenwood, 2003).

Criteria for school participation included: (a) a computer in each CWPT classroom capable of running the CWPT-LMS software and with Internet access, (b) providing time for teachers to participate in CWPT professional development, (c) using CWPT for spelling or reading, (d) using the CWPT-LMS software to send CWPT data to researchers, and (e) including at least one student with a disability in each CWPT classroom. Participating K-5 elementary schools had 14 to 73 teachers with student populations of 160 to 745. These schools were a mix of public and parochial located in urban areas of Florida and Maryland and rural areas of Nebraska and Mississippi. The researchers and developers resided at the Juniper Gardens Children's Project in Kansas City, Kansas.

Procedures

At the conclusion of the 2002 academic year, the study progressed through the following four stages: (a) SC training, (b) local CWPT training and setup, (c) CWPT implementation, and (d) continuous electronic data transfer from schools to researchers.

CWPT training. We used a trainer-of-trainers model, whereby NSCs and SCs were trained at a three-day training workshop in Kansas City. The SCs subsequently trained the teachers at their local schools. We trained participants using the same instructional format that SCs were to use to train their teachers during teacher inservices. At the workshop, participants learned how to implement CWPT, use the CWPT-LMS software, recruit and train teachers, negotiate contracts with schools, deliver technical assistance, and monitor, report, and evaluate school progress. Participants received the materials necessary for CWPT implementation (laminated point-recording sheets, dry-erase markers, etc.) and a CD with training resources that included videos of CWPT implementation, CWPT-LMS training exercises with an LMS simulator, PowerPoint® training presentations, and printable CWPT materials.

Local CWPT training and setup. Following the CWPT training workshop, SCs organized and conducted a similar training workshop with the teachers they recruited to implement CWPT. SCs conducted the single-day training workshops using the training assets and presentations they had received at the KC training

workshop. Following the local workshop, teachers installed the CWPT-LMS on their classroom computer and added their class and student names to the program's electronic roster. Then teachers registered at the researchers' website, providing general demographic information and what content they planned to teach with CWPT. Finally, teachers created the instructional content materials necessary for CWPT pre- and posttests and peer-tutoring sessions.

CWPT implementation. After preparing content and setting up the software, teachers were ready to implement CWPT and enter data into the CWPT-LMS. Each week began with a pretest over the week's content, followed by at least three CWPT tutoring sessions, and concluding with a posttest over the week's content. Either the teacher or a student recruited by the teacher entered data into the CWPT-LMS from the pretests, tutoring sessions, and posttests. Teachers could then use the progress monitoring graphs and/or the program's Advisor to inform the next week's instruction and content based on classwide and individual students' progress. Teachers also conducted three reading, math, and spelling curriculum-based assessment probes with targeted students with disabilities as part of the project's study of CWPT's effectiveness. (To maintain the focus of the current manuscript, student outcome data are not reported.) Also, SCs conducted three implementation fidelities with each teacher using a researcher-developed fidelity checklist.

Continuous electronic data transfer from schools to researchers. Throughout the academic year, teachers sent their CWPT data to researchers in Kansas City via the Internet by clicking a data transfer button in the CWPT-LMS software. This action sent all of their data to a secure online database accessible only by the researcher team. Additionally, SCs sent their fidelity of implementation and assessment probe data to a secure online database via password-protected web forms located on the project's website.

Measures

For Study 1, we measured implementation based on teachers' completion of five tasks: (a) teacher registration on the CWPT website, (b) completion of curriculum-based assessment probes, (c) CWPT administration, (d) sent CWPT-LMS data via file transfer protocol, and (e) completion of CWPT fidelity of implementation checklist. With the exception of CWPT administration, all tasks resulted in a time-stamped electronic permanent product, which served as implementation verification. CWPT administration was verified by SC self-report, and was further verified for schools that sent CWPT-LMS data (Task 4). Implementation was measured in terms of the percent of tasks completed by school and teacher.

Results

Table 2 shows the degree to which the teachers at the five schools completed the implementation tasks. All teachers in Schools 1 and 2 completed all five tasks. Task completion varied between Schools 3, 4, and 5, with School 5 not completing any tasks. On average, 80% of SCs had all their teachers registered at the CWPT website (Task 1), 60% completed the curriculum-based assessment probes (Task 2), and 40% of SCs completed fidelity of implementation checklists (Task 5). In three of the five schools, all teachers implemented CWPT (Task 3) in their classrooms, 25% of teachers in School 3 implemented it, and no teachers in School 5 implemented it.

Schools 1 and 2 were the only schools in which all teachers sent us their CWPT data via the CWPT-LMS (Task 4). Only 12% of teachers from School 4 sent data, and no teachers from Schools 3 and 5 sent data.

Table 2

Percentage of Teachers who Completed Each Implementation Task for Study 1

School	Site Coordinator	Implementation Tasks 1	2	3	4	5	Overall Mean
1	Principal	100%	100%	100%	100%	100%	100%
2	Doc Student	100%	100%	100%	100%	100%	100%
3	Vice-Principal	100%	100%	25%	0%	0%	45%
4	Doc Student	100%	0%	100%	12%	0%	42%
5	Teacher	0%	0%	0%	0%	0%	0%
Mean Percent		80%	60%	65%	53%	40%	57%

Implementation Criterion

1. Teachers registered at the website and transmitted a confirmation report via the web
2. Target student CBM data were administered and sent to JGCP
3. Teachers implemented the CWPT strategy
4. Teachers used CWPT-LMS (setup classroom, entered data, and sent data to JGCP)
5. Site coordinators returned completed fidelity implemenation checklists via the web

Discussion

Based on the results above, three categories of implementation barriers emerged: lack of support from a school's administration, teacher attendance at the local CWPT workshop, and technology problems. Without the support of their administration, teachers and SCs had difficulty moving the project forward, particularly when they ran into problems (e.g., technology issues, finding time to conduct assessments and fidelity observations) Failing to learn CWPT procedures and the research protocol at the CWPT workshop put teachers and classrooms behind from the outset, making it difficult for implementation to proceed. Because most schools encountered some form of technology problem, it was difficult to assess the impact of this factor on implementation. However, depending on the nature of the problem, an inability to solve these problems appeared to delay implementation progress.

Schools 1 and 2 (high implementation) both enjoyed strong administrative support, provided adequate teacher training, and worked closely with project staff to troubleshoot technology challenges. School 3 (low implementation) had strong administrative support, but the training workshop was poorly attended and they encountered only sporadic technology support. School 4's (low implementation) training was sufficient, but administrative and technology support was weak. School 5 (no implementation) experienced multiple barriers, including limited administrative support, poor training, and lack of onsite technology support.

Although we did not measure communication between research staff and SCs, we believed that this factor was related to implementation success. Anecdotally, if SCs rarely returned phone calls and/or emails, it suggested that they were experiencing implementation problems and that implementation, therefore, was not likely to progress. This was different from schools that experienced implementation problems, communicated these problems to the research staff, and solved the prob-

lems. Indeed, we suspected that patterns of communication might emerge as early indicators of future implementation failure or success. Thus, a key feature of Study 2 was to measure communication between research staff and SCs to identify such communication patterns.

Study 2

In Study 2 we used a more sensitive measure of implementation to untangle the relationships between patterns of implementation and the contextual variables that influence those patterns, and we collected data on the frequency and time of communication between researchers and SCs. (See Buzhardt, Greenwood, Abbott, & Tapia [2006] for additional details about this study.) Study 2 addressed the following research questions:

1. What was the relationship between rate of implementation and communication frequency?
2. What contextual variables (barriers) prevented full implementation or delayed the rate of implementation?

Methods

Most of the Study 1 methods and procedures were replicated for Study 2. Specifically, we used the same Administrative/Adoption model (Figure 3), trained SCs similarly with minor modifications to the presentations and materials, and asked participants to send the same type of data. The primary methodological differences between the two studies were a larger sample size for Study 2, a more detailed breakdown of implementation tasks, and the collection of additional implementation data. Therefore, we report only these unique methodological aspects for Study 2.

Participants

Fifty-six general education teachers in nine schools across Maryland, Mississippi, Nebraska, Kansas, and Florida participated in Study 2. Schools reflected a range of rural, urban, and suburban communities, a mix of parochial, public, and Bureau of Indian Affairs school types, and culturally diverse student populations. At each school, there was an SC, who trained the teachers and oversaw implementation of CWPT and the research protocol.

Measures

For Study 2, we measured the following dimensions of implementation: (a) the tasks required to move from no implementation to full implementation, (b) when each school completed a task, (c) the number of weeks it took for each school to achieve its highest level of implementation, (d) the frequency of communications (i.e., email and phone calls) between the researchers and school staff as implementation progressed, and (e) who initiated (i.e., sender or receiver) these communications.

To develop a more sensitive measure of implementation, we identified seven additional implementation tasks, which are described below. All but two of these tasks (teacher training and target student selection) resulted in a permanent product as evidence of the task's completion (e.g., databases populated via File Transfer Protocol [FTP] or web forms, training attendance, mailing of paper forms).

Table 3
Summary of Implementation Rate and Communications for All Schools

		Implementation Tasks			Communications					
		Wks to	Tasks	Wks/	Frequency			Communications/Task		
School	State	Complete	Completed	Task	Sent	Received	Total	Sent	Received	Total
1	MD	30	12	2.5	25	14	39	2.1	1.2	3.3
2	MD	36	12	3.0	41	27	68	3.4	2.3	5.7
3	NE	40	12	3.3	19	11	30	1.6	0.9	2.5
4	NE	43	12	3.6	40	19	59	3.3	1.6	4.9
5	MD	49	12	4.1	50	36	86	4.2	3.0	7.2
6	KS	50	12	4.2	36	22	58	3.0	1.8	4.8
7	FL	52	11	4.7	23	6	29	2.1	0.5	2.6
8	MS	52	10	5.2	20	6	26	2.0	0.6	2.6
9	FL	52	7	7.4	8	0	8	1.1	0.0	1.1
	Mean	44.9	11.1	4.2	29.1	15.7	44.8	2.5	1.3	3.9
	Range	30-52	7-12	2.5-7.4	8-50	0-36	8-86	1.1-4.2	0-3	1.1-7.2
					35.167	21.5	56.667	2.9306	1.791667	4.7222

Research staff monitored rate of implementation recording when each school completed each of the 12 tasks:

1. Attendance at the KC CWPT training workshop (similar to Study 1)
2. SC estimate of the number of CWPT-LMS installation CDs needed
3. SC registration at the CWPT website
4. Teacher registration at the CWPT website
5. CWPT-LMS software installed on teachers' computers
6. Completion of local CWPT training workshops.
7. Teacher selection of target students to evaluate the effectiveness of CWPT in reading and spelling. Each teacher selected two low-, two middle-, and two high-achieving students, and, if available, two students with individualized education programs (IEPs)
8. Sending signed parental consent forms
9. Conducting a CWPT
10. Sending students' weekly CWPT progress data via the Internet
11. Sending implementation fidelity data via web forms on the CWPT website
12. Receipt of summative student achievement data in reading, spelling, and math via web forms located on the CWPT website

Communication between researchers and SCs. Based on our experience in Study 1, we expected early and continuous communication between researchers and SCs to predict implementation success. All emails sent to and received from SCs were saved and printed, and all phone calls were described in a phone communication log. We gave each communication a unique alphanumeric identification number. We then plotted communication contacts as a cumulative record for each school. This provided a graphic representation of each school's rate of communication throughout the school year (Figures 4 and 5).

Results

Relationship Between Rate of Implementation and Communication Frequency

For each school, Table 3 shows the number of implementation tasks completed, weeks to complete them, and the number of communications. Schools 1-6 completed all implementation tasks and averaged 56.7 communications (range = 30-86), compared to an average of 21 (range = 8 – 29) for schools that partially implemented the model. Using a Pearson's product-moment correlation, significant positive correlations were found between the number of tasks completed and sent communications ($r = .72$; $p < .05$), and the number of tasks completed and received communications ($r = .69$; $p < .05$). No significant correlation was found between the number of communications and the number of weeks to reach full implementation.

Figures 4 and 5 display cumulative records of selected schools' rate of implementation and communication frequency, with time in weeks along the x axis and tasks completed along the left y axis. Completing a task raises the school's task implementation data line. Similarly, each communication increased the school's communication data line (right y axis). We coded "Sent" communications as those sent by us to the SCs, and "Received" communications as those received by us from the SCs. Steeper inclines indicate faster implementation or more frequent communication.

Figure 4. The implementation progress and communications sent and received between two schools that reached full implementation.

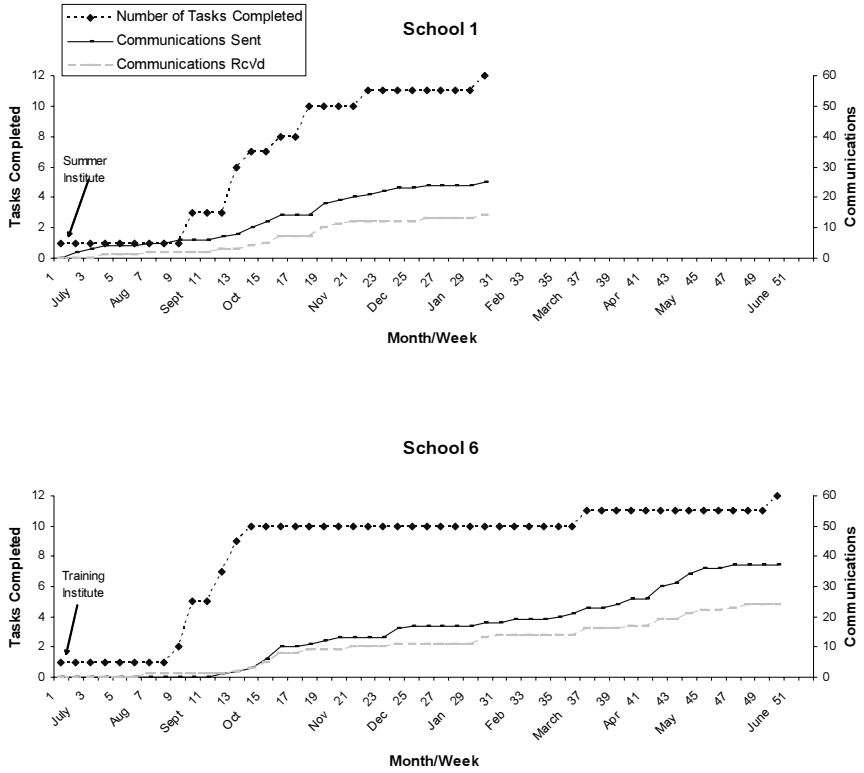
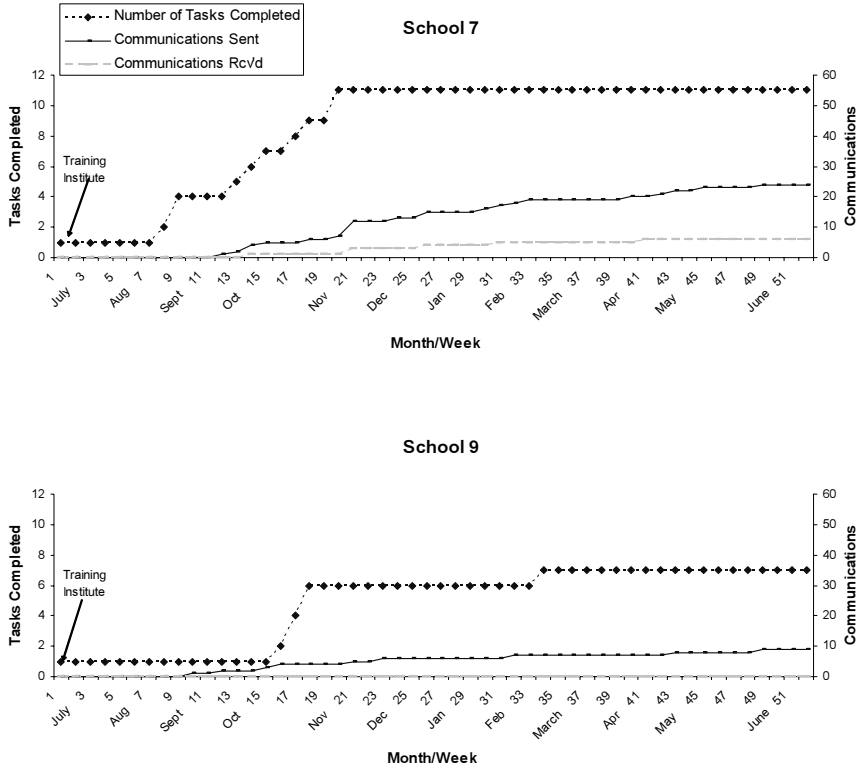


Figure 4 shows the divergence between two full implementers: the fastest and slowest. School 1 completed all implementation tasks 20 weeks faster than School 6 and had 18 fewer total communications. Implementation progressed quickly for both schools during the 8-9 weeks after the training institute. Although School 6 was the fastest school to complete 10 tasks, a new SC temporarily took over in late October for the primary SC, who returned in April. Another important difference between these schools' graphs is the time of the initial communication after the training workshop. School 1's first communication with us occurred more than a month earlier than School 6's. This indicated that the school was preparing for implementation early and would be more likely to start CWPT soon after the start of the academic year.

Figure 5 shows implementation progress graphs for two partially implementing schools. Although School 7 only completed 4 more tasks than School 9, the graphs show that it took School 7 three months *less* time to complete 11 tasks than it did for School 9 to complete 7 tasks. The schools also differed in their patterns of communication. School 7's SC communicated on six occasions with the research

Figure 5. The implementation progress and communications sent and received between two schools who did not achieve full implementation.



staff, while School 9's SC never communicated with the research staff after the training institute. By comparison, Schools 1 and 6 (Figure 4) communicated 14 and 22 times, respectively, with researchers. Also, School 7's initial communication came well into the school year, nearly 1.5 months later than School 6's and 2.5 months later than School 1's.

Contextual Variables (Barriers) Preventing Full Implementation or Delaying the Rate of Implementation

Table 4 sorts the list of barriers from the most frequently experienced to the least experienced (top to bottom), and arranges the schools from fastest full implementers to slowest partial implementers (left to right). Barriers 1, 6, 8, and 9 were based on self-report from SCs.

A visual analysis of Table 4 shows a general pattern, whereby schools further to the right of the table experienced more barriers (shaded blocks) than those on the left. The partially implementing schools experienced more barriers (average of 5.7) than any of the fully implementing schools (average of 2). Clearly, the accumulation of multiple barriers had a significant impact on a school's ability to reach

Table 4

Barriers Affecting Implementation by School

Hypothesized Barriers	Schools[a]									Percent of Schools with Barrier
	Full Implementation						Partial Implementation			
	1[b]	2	3	4[b]	5	6	7[b]	8	9	
1	■	■	■	■	■	■	■	■		89
2				■			■	■	■	44
3							■	■	■	33
4						■		■	■	33
5		■	■	■					■	33
6				■		■		■		33
7								■	■	22
8								■	■	22
9							■			11
Total	1	2	2	3	1	3	4	7	6	

Notes. [a] = Fast to slow in rank order left to right. [b] = Schools that implemented CWPT-LMS in Study 1.

Barriers were defined as follows:

1 - Technology problem
2 - Late communication start (first received communication after Sept. 1)
3 - Limited Communication (less than 10 received)
4 - Limited onsite tech support
5 - Teacher as Site Coordinator
6 - Change in Site Coordinator
7 - Late implementation startup (completed 2nd task after Sept. 1)
8 - Limited administrative support
9 - Overburdened Site Coordinator

full implementation. Overall, the impact of these variables on implementation may be judged by their effect on the schools that experienced them. For example, Variable 1 had little impact on implementation because all schools experienced it. On the other hand, Variable 7, which was experienced exclusively by partial implementers, likely had a significant impact on implementation.

Two variables that did not emerge as clear barriers were Variable 1, Technology Problem, and Variable 5, Teacher as Site Coordinator. All schools but School 9 experienced some technology problem, but it did not appear to slow down implementation, as evidenced by the fact that the fastest full implementers experienced technology problems. However, this variable did appear to become a barrier at schools with limited onsite tech support (Barrier 4). Schools that experienced both of these variables were three of the four slowest/partial implementing schools. In Study 1, schools that had a teacher as a SC failed to reach full implementation. In Study 2 this variable was not a clear barrier, however. Although the school with the fewest completed tasks had a teacher SC, two of the three fastest full implementers also had teacher SCs. Also worth noting is the lack of a clear impact of prior participation in Study 1 on a school's implementation. Of the three schools that participated in Study 1, one was a partial implementer, another was a mid-range full implementer, and a third was the fastest full implementer.

Discussion

In Study 2 we sought to investigate further the relationship between contextual variables and schools' rate of implementing CWPT and the research protocol. For this study, we had a larger sample of schools and SCs, used a more sensitive measure of implementation, measured communication, and examined a specific set of variables that we expected to impact implementation based on Study 1.

Supporting the anecdotal reports in Study 1 regarding the relationship between communication and implementation success, communication was indeed found to be related to implementation. Thus, the statistically significant positive correlation between the number of tasks completed and frequency of communications suggests that full implementation is less likely to happen without an open and continuous line of communication between SCs and research staff. We received relatively few communications from schools that participated in Study 1 (Schools 1, 4, and 7), supporting McInerney and Hamilton's (2007) finding that less support is needed to facilitate implementation beyond the first implementation year. This may also explain the lack of a statistically significant correlation between the number of weeks to reach implementation and communication frequency.

The earliest indicator of implementation success was receiving a communication from the SC prior to September 1. Only one school that communicated with us after this date went on to full implementation. As schools begin to prepare for implementation, they inevitably have questions, need additional materials, or require technical assistance. Perhaps the need for early and frequent communication might be reduced by analyzing the content of the communications and addressing frequently occurring problems in the training workshop and/or the training manual. All but three of the Study 2 schools were first-time CWPT users. As they become more experienced with CWPT and the implementation procedures, they will likely

require less initial and ongoing assistance (McInerney & Hamilton, 2007). Nonetheless, the first year of implementation is critical to sustained use, so addressing these usability issues is critical to CWPT's scalability.

In addition to providing a final graphic analysis of overall rate of implementation and communication, maintaining these graphs served as an effective tool for monitoring school progress and quickly identifying potential implementation delays during the course of the project. For example, as illustrated in Figure 4, the number of communications sent to School 6 began accelerating at Week 42 when it became apparent that the school was unlikely to reach full implementation by the end of the year. It is important to note that the final implementation task for this school was to send us outcome data for their selected students, not a task related specifically to the CWPT process. Tasks that involve the CWPT process would necessitate earlier communications.

By examining the relationship between barriers experienced and implementation progress (Table 4), we extrapolated categories: Strong Barrier, Weak Barrier, and Non-Barrier.

Strong barriers (2, 3, 4, 7, 8, and 9) were those experienced almost exclusively by the partial implementers, Weak barriers (5 and 6) were experienced equally by partial and slow implementers, and non-barriers (1) were experienced by nearly all implementers. Categorizing factors in this way provides a means of determining the likelihood of successful implementation at a given school based on the presence or absence of these factors. Also, it identifies areas that we, as developers, should address in order to increase the range of potentially successful schools. For example, limited onsite technology support (Barrier 4) is likely to be experienced by a large proportion of schools. Technology support was most often needed during the CWPT-LMS installation process or when there was a conflict between the CWPT-LMS software and a computer's operating system. Converting the CWPT-LMS program from a stand-alone software package to an online, web-based application would significantly reduce the opportunity for such conflicts, as would making it "platform independent," such that users could use it with a standard web browser without having to install software.

Strong barriers (2, 3, 4, 7, 8, and 9) consisted primarily of factors related to communication. Lack of communication at the beginning of the school year (Barrier 2) was often an indicator of limited communication overall (Barrier 3). Limited onsite tech support (Barrier 4) impacted schools' ability to solve technical problems (Non-Barrier 1), which was experienced by nearly all schools. Experienced in Study 1 and replicated in Study 2, beginning implementation after the start of the school year (Barrier 7) hampered implementation presumably because, by this time, teachers had established their routines and schedules, making them less likely to begin a new program. Limited administrative support (Barrier 8) and an overburdened SC (Barrier 9) were related, in that they often meant that teachers had little or no additional time or help in launching CWPT or the required research protocol.

Weak barriers (5 and 6) were related to the SC. Reported as a significant barrier in Study 1, Barrier 5 (teacher as Site Coordinator) was overcome by two of the three schools that experienced it. Common between the two schools that overcame this barrier was that they were both small private schools (School 2: Catholic,

School 3: Native-American tribal school), and School 9, which did not fully implement, was a large urban public school. The only *non-barrier*, reported technology problem, was experienced by nearly all schools. The presence of onsite technical support appeared to offset the impact of this factor.

Overall Discussion

The essence of scaling up a practice is the degree to which others can fully implement the practice from a distance relatively independent of the developers or some other centralized entity. Barriers to this type of implementation originate from three sources: the practice itself; implementation support tools/processes; and factors associated with the practitioners. For CWPT, efforts have been underway for the past 30 years to develop and evaluate the first two sources (Table 1). The data, methodological tools, and procedures described in these two studies have helped identify factors associated with practitioners that affect CWPT implementation from a distance. Understanding these barriers helps us dampen their negative impact by adapting CWPT resources and training materials to address these factors. Additionally, the methodology provides a template that could be used to investigate other strategies.

These studies show a methodological progression from anecdotal evidence of potential implementation barriers to a more quantitative and precise approach to identifying barriers. Within our scaling-up model, rate of implementation proved to be a more sensitive measure of implementation success compared to measuring only implementation completion. Using this measure allowed us to make finer discriminations between levels of implementation. Figure 4 clearly shows the divergence between the fastest and slowest implementers, and Table 4 shows the factors that may have impacted this variation. Rate of implementation is particularly appropriate for measuring the use of educational interventions in which it is important to uncover interactions between dosage (amount of an intervention or amount of time exposed to an intervention) and effectiveness of an intervention.

This approach may be applied to measuring implementation of other educational interventions or practices. The key ingredients to this approach include the following: (a) a clear and complete task analysis of full implementation, (b) a method of accurately knowing the date at which each task is completed, and (c) a method of plotting and monitoring task completion (e.g., Excel® spreadsheet or similar graphing program). For CWPT, we plotted rate of communication in parallel with rate of implementation because we hypothesized a positive relationship between these two variables. However, other continuously occurring variables could be plotted in addition to, or instead of, communication, depending on current theory or prior experience. For example, for an intervention that requires users to login to a website to set up class rosters, enter data, and download progress monitoring graphs, one might monitor the rate of logins to the website or graph downloads. Less frequent or late initial logins might predict future implementation problems.

What Did We Learn About the Factors Related to CWPT Implementation at a Distance from the Developers?

Based on data from these two studies, barriers or factors related to implementation fall into three categories: communication, administrative/staff related,

and technology. These findings are in accord with other investigations, which found communication (McInerney & Hamilton, 2007) and administrative support (Klingner et al., 2003; McInerney & Hamilton, 2007; Vaughn, Klingner, & Hughes, 2004) to be related to large-scale implementation success.

The two dimensions of communications that related to implementation were late start of communication after the training workshop and infrequent communications received from the SC (fewer than 10 throughout the year). Although these factors may not be barriers themselves, they are, at the very least, indicators of other problems that could disrupt implementation progress. Administrative and staff-related issues include changing SCs during the year, lack of support from the school or district administration, and overburdened SCs. A backup SC who is familiar with the implementation procedures could help circumvent problems associated with changing SCs. Such a backup SC could also assist in these duties if the primary SC becomes overburdened with other duties. Because we know that limited and late communication signals slow or incomplete implementation, future implementation procedures might also include a scheduled teleconference between the SC and researchers/developers one to two weeks before the start of classes. In addition to prompting SCs to begin implementation preparation, this would help identify and troubleshoot impending implementation problems before classes start.

In addition to the barriers identified in Table 4, we can report that all parochial and tribal schools achieved full implementation, but no public school fully implemented. We did not include school type as a barrier because it has not been observed in prior work. There are many potential explanations for this observation. Public schools tend to have a more complex administrative bureaucracy, perhaps making them more resistant to the introduction of new classroom procedures than other kinds of schools. For example, when School 9's (a public school) SC became burdened with the principal's additional duties, the school's organizational structure was not flexible enough for her to pass the SC duties to someone else. Conversely, School 4 (a tribal school) also changed SC personnel, but implementation continued to completion.

Implications for Future Research

Although these studies help us understand the factors that affect CWPT implementation from a distance, the findings have merely opened the door to this next phase of the CWPT research program. Informed by these studies, changes to implementation procedures and training materials will improve the probability of future implementation success. Next, large-scale empirical investigations will identify any causal links between contextual variables and rate of implementation. The small sample sizes of the investigations reported here limit our ability to generalize the findings to the varied school populations. An empirical investigation would also allow us to investigate factors that are difficult to control without randomization but have been shown to affect implementation and maintenance, such as the school or district's acceptance of innovative practices, student acceptance, the personalities of teachers and school leaders, and how easily a practice integrates with existing school practices (Gersten, Morvant, & Brengelman, 1995; Klingner, 2004). A sufficiently powered randomized study would help illuminate these factors that facilitate and impede implementation.

Finally, other variables need to be investigated that could not be included in the current project. For example, all SCs received monetary incentives for participating in the project. It would not be financially practical for developers to pay staff to facilitate and monitor implementation in every school that uses CWPT; thus, we need to identify other incentives that will help spread and sustain CWPT use in schools. The most likely solution to this issue is to secure buy-in from district-level leaders who can encourage the use of CWPT procedures throughout the district (Darling-Hammond & McLaughlin, 1995). We also did not investigate how failure to attend the three-day CWPT workshop would affect implementation. Our own anecdotal observations and McInerney and Hamilton's (2007) investigation suggest that implementation fidelity and maintenance would suffer without an intensive, multi-day face-to-face training workshop. Unfortunately, this intensive, site-specific training limits CWPT's scalability. Developing an effective and rigorous distance certification training program would be a cost-effective solution for schools and districts that cannot afford the time and money required to send representatives to attend workshops. Continued research, either through small formative evaluations or large-scale randomized trials, to investigate these and other factors that impact CWPT implementation is critical to continued scaling up and sustainability of this evidence-based practice for children with and without disabilities.

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