THE IMPACT OF PROFESSIONAL DEVELOPMENT ON TEACHER LEARNING, PRACTICE AND LEADERSHIP SKILLS: A STUDY ON THE INTEGRATION OF TECHNOLOGY IN THE TEACHING OF WRITING

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ABSTRACT

This study reports on the design, implementation, and outcomes of a research-based professional development program aimed at helping teachers integrate technology in the teaching of writing. The program was funded by the National Writing Project (NWP), a pioneer professional development model for teachers of writing across the United States. Specifically, the study investigates the ways in which key features of the professional development program influenced teacher knowledge, practices, beliefs, and leadership skills with regard to the role of technology in the teaching of writing. Findings of the study indicated that the program had a positive impact on four aspects of teacher learning: (a) acquisition of new knowledge, (b) application of technology into the teaching of writing, (c) beliefs toward using technology in writing, and (d) opportunities for exercising leadership roles. Findings from this work have important implications for professional development designers, as well as school and district personnel directly involved in the design and implementation of technology professional development programs for teachers that target specific content areas.

INTRODUCTION

Writing skills are critical for student success in school, college, and the workplace. According to a recent report by the National Commission on Writing (2006),

writing proficiency is not only essential for new learning and knowledge acquisition but it is also strongly correlated with career success. Although developing fluency in writing has always been a fundamental goal of schools, the most recent data from the National Assessment of Educational Progress (2002) indicate that two thirds of the nation's students performed below proficiency in writing. These findings indicate that even though most students have mastered writing basics, few are capable of creating the type of sophisticated writing necessary in today's modern economy.

The rapid evolution of new technologies in the last two decades, however, has transformed the ways in which people communicate, collaborate, read, and write and offers new possibilities for supporting and improving student writing. Word processors have introduced new ways of generating, organizing, and editing text, thereby making tedious revision tasks easier. But more importantly, the advent of the Internet, multimedia, and electronic communication tools (e.g., e-mail, Web conferencing) has altered the ways in which people communicate and share with one another, generating a genuine purpose for writing, and creating an enhanced motivation to write (Jonassen, 2005). The popularity of these tools among younger generations of students in particular, provides an excellent opportunity to improve writing proficiency by developing new approaches in the teaching of writing that are grounded in technology. Yet, it is widely acknowledged that teachers face challenges in taking advantage of the new possibilities offered by technology (Becker, 2001; Cuban, 2001). According to the National Commission on Writing (2006), the best avenue for helping teachers integrate new technologies in the teaching of writing lies in high-quality professional development.

While schools and districts have already placed increased attention on teacher professional development, substantial, content-focused technology professional development has been rare (Hughes, Kerr, & Ooms, 2005). In a survey of public school teachers during the years of 1997-1999, the National Center for Educational Statistics (NCES, 2000) reported that most professional development programs consisted of one workshop sessions and were devoid of follow-up support and curriculum connections. Not surprisingly, such programs often failed to foster meaningful teacher learning. As a result, there is an urgent need to provide access to high-quality, research-based professional development programs. Such programs need to help teachers build their technology competence, develop an understanding of the ways in which they can use new technologies in the teaching of writing, and reconsider their inherent attitudes about the value of writing grounded in new technologies.

This study describes a comprehensive, research-based professional development program designed to help teachers integrate technology in the teaching of writing. The program was funded by the National Writing Project (NWP), a pioneer professional development model for teachers of writing across the United States. The study also investigates the ways in which key features of the

professional development program influenced teacher knowledge, practices, beliefs, and leadership skills with regard to the role of technology in the teaching of writing. To date, few studies exist that demonstrate the impact of comprehensive, content-focused, technology professional development on teacher learning and practice (e.g., Hughes, 2005). Further, none of these studies focuses specifically on the integration of technology in writing. Findings from this work have important implications for professional development designers, as well as school and district personnel directly involved in the design and implementation of content-focused professional development on the use of technology to improve both the teaching and learning of writing.

THEORETICAL FRAMEWORK

The Role of Technology in the Writing Process

Effective use of technology can support and improve the process of writing helping students compose, organize, and edit text more efficiently as well as learn the rudiments of grammar (National Commission on Writing, 2006). Studies conducted to assess the effectiveness of word processing tools have consistently documented positive effects on student writing skills. Students who compose on computers write longer pieces, are more motivated to write, and are more willing to revise compared to students composing with pen and paper (Cochran-Smith, 1991; Daiute, 1986; Kulik, 2003; Russell, Bebell, Cowan, & Corbelli, 2003).

Above and beyond word processing, however, rapid advances in technology have also resulted in a range of multimedia and electronic communication tools that can support the social process of writing. According to the National Commission on Writing (2006), acquiring a process by which to think about what to say often depends on social interactions with peers and teachers. New telecommunication tools such as e-mail, web conferencing, instant messaging, blogs[1], and wikis[2] can foster a collaborative, interactive environment that supports social interaction and community-building (Hewett, 2000; Jonassen, 2005; Karchmer, 2001; Knowles & Hennequin, 2004; Leu, 2000). In a meta-analysis on computers and writing, Goldberg, Russell, and Cook (2003) consistently found that when students wrote on computers, writing became a social process of interaction, collaboration, and sharing.

Blogs and wikis, in particular, provide opportunities for participants to write in a collaborative space where ideas are shared, questions are asked, and social cohesion is developed (Huffaker, 2004). As a result, they can help establish a

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[1] A blog is a Website where entries are made in journal style and displayed in a reverse chronological order.

[2] A wiki is a type of Website that allows the visitors themselves to easily add, remove, and otherwise edit and change some available content, sometimes without the need for registration.

classroom climate that nurtures the writing process. In a blog, the author is able to publish instantly online from any Internet connection. Blogs promote active learning by optimizing a collaborative environment through writing that invites audiences to read, reflect on the postings, and engage in electronic conversations (Kennedy, 2003; Richardson, 2006). Wiki, the Hawaiian name for quick, is a Web-based application that facilitates collaborative editing of content. The most famous wiki at present is Wikipedia,[3] an online collaborative encyclopedia. Once wiki users have been granted editing privileges, they can edit pages freely, and changes are tracked in the wiki history. When users click on page history, they can see what changes were made, when they were made, and by whom (Richardson, 2006). With the ease of publishing pages immediately, blogs and wikis provide a simple, yet powerful, way for asynchronous collaboration.

Use of blogs and wikis has increasingly provided an expanded motivation to write. According to the National Commission on Writing (2006), "All those people who said they hate writing and can't write and don't want to write, *can* write and *do want* to write. In fact, they can't be turned off" (p. 16). The Commission urged teachers to build on students' fascination with "blogging" and "instant messaging" to help develop writing competence. As a result, this work focuses on helping teachers understand the ways in which blogs and wikis, as well as other forms of technologies, can be integrated into the content and social context of the writing classroom.

Characteristics of Effective Professional Development in Writing and Technology

Integrating technology into classrooms in ways that transform teaching and learning has proven to be a more challenging task than originally thought (Meier, 2005). Nationwide studies indicate that in the teaching of writing, computers are primarily used for word processing tasks and research on the Internet (Becker, 2001; U.S. Department of Education, 2003). While such uses are valuable because they help students automate previous instructional tasks, they fail to capitalize on the affordances of technology to create authentic, collaborative learning environments that nurture the writing process.

The lack of innovative technology use in the classroom is partly attributed to the inadequacy of professional development available to teachers. A report by The Milken Exchange on Education and Technology (1998) found that teachers from 21 states surveyed received only 5.1 hours of training on integrating technology over a 12 month period. Furthermore, the traditional model of technology-based training for teachers consisted of one session workshops often disconnected from practical applications in the classroom or subject matter. This traditional model lacked appropriate time, follow-up support, and a link to cognition, content,

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[3] Wikipedia is available online at: http://www.wikipedia.org/

and learning. As a result, it rarely transformed instructional practice (Hughes, 2005; Klingner, 2004; NCES, 2000; Sparks & Hirsh, 1997).

To facilitate the integration of technology in the teaching of writing, teachers must develop "an overarching conception of their subject matter with respect to technology and what it means to teach with technology—a technology pedagogical content knowledge" (Niess, 2005, p. 510). Thus, it is important that we provide teachers with opportunities to experience writing grounded in new technologies as a way of helping them develop both knowledge of technology and knowledge of their subject area (National Commission on Writing, 2006; Niess, 2005). Encouraging teachers to see themselves as writers and model writing for the benefit of their students are critical components of effective professional development on the teaching of writing (e.g., the NWP).

During the last decade, an array of research has also emerged that can inform the design of high-quality professional development programs, including technology-related programs (Corcoran, 1995; Garet, Porter, Desimone, Birman, & Yoon, 2001; Guskey, 2003; Hughes, 2005; SRI International, 2002). An examination of this body of work revealed seven key principles most frequently associated with changes in teacher learning and practice: (a) focus on content and pedagogical knowledge, (b) reform-type activities, (c) relevance of activities to teacher needs, (d) opportunities for active learning, (e) extensive duration, (f) collective participation, and (g) opportunities for leadership. This study describes a professional development program aimed at helping teachers integrate technology in the teaching of writing that encompassed all aforementioned principles. More importantly, the study investigates the impact of the program on teacher learning, practice, and leadership skills.

RESEARCH CONTEXT

Description of the Delaware Writing Project Technology Initiative

The professional development initiative employed in this study was funded by a Technology Matters grant from the NWP. The NWP is a professional development model with 195 university-based sites in all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Each of these sites conducts annual summer institutes, attended by the most experienced teachers in the area. These teachers prepare for leadership roles by demonstrating their most effective practices, studying research materials, and improving their knowledge of writing by *becoming writers* themselves. They bring their new knowledge and skills back to schools, for the benefit of students and fellow teachers. NWP sites serve over 100,000 teachers annually and have served an estimated one million teachers since the inception of the program as a single site in California back in 1974. The professional development program employed in this work was

offered through the Delaware Writing Project (DWP), a site affiliated with the University of Delaware.

The overarching objective of the Delaware Writing Project technology initiative (DWPti), as the program was called, was to help teachers improve their teaching of writing through the use of technology. In particular, the DWPti aimed at helping teachers: (a) increase their basic technological skills; (b) learn how to use a range of tools (e.g., blogs, wikis, digital storytelling, Inspiration[4]) that can support the teaching of writing; (c) increase their understanding of the ways in which electronic communication tools can be used in writing; (d) apply technology in their teaching of writing; (e) reconsider their beliefs about the value of grounding writing in new technologies; and (f) strengthen their leadership skills.

The DWPti extended over a nine month period (March-November, 2005) to allow teachers time for learning. More specifically, the program started in March 2005 with two spring meetings, continued with an intensive two-week summer technology institute (typical of the NWP professional development model), and concluded with follow-up meetings and classroom observations throughout the fall semester. In addition to face-to-face meetings, the program incorporated extensive online discussions through a blog that was set up specifically for teacher participants. Figure 1 presents a timeline of events associated with the DWPti.

To achieve its intended goals, the DWPti adhered to the principles of the NWP. In particular, during the first phase of the program (March-June) teachers *studied* research material on the integration of technology in writing and *became writers* themselves by using a class blog that enabled sharing of ideas and collaboration with peers. The intensive two-week summer institute focused on building technology competence and an understanding of technology integration in the teaching of writing. Specifically, teachers learned how to create a blog and wiki, develop graphical representations using Inspiration, and design a digital story using multimedia. In the last component of the DWPti, teachers developed a workshop that *demonstrated* their most effective practices implementing technology in their classroom. Participants presented their workshop to colleagues and administrators across the state of Delaware as a way of cultivating their leadership skills and sharing their new knowledge with their peers.

Critical Components and Activities of the DWPti

In addition to adhering to the NWP design elements, the DWPti was consistent with key principles of effective professional development reported in the research literature. Table 1 illustrates the components and specific activities of the DWPti and their relationship to key principles of effective professional development discussed in the literature.

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[4] Inspiration (Inspiration Software, Inc.) is a software package that allows users to create graphic organizers that visually represent concepts and relationships.
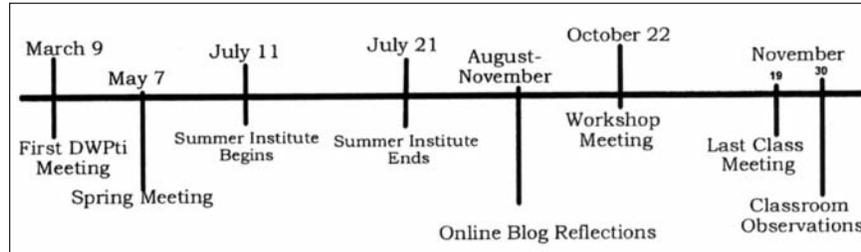
Figure 1. Timeline of DWPti activities.

METHODS

Participants

Participants for case analysis included four elementary and one middle school classroom teachers from Delaware public schools. Participants were selected from a pool of 10 teachers who attended the DWPti.[5] Teachers were recruited from K-12 schools across the state of Delaware based on previous technology experiences and willingness to improve their teaching of writing through the use of technology. While the elementary teachers taught all content areas, the middle school teacher taught only science, reflecting the commitment of the DWPti and the NWP to see effective writing practices implemented across curriculum areas. As a result of their participation, all teachers received three graduate credits and a stipend. Table 2 demonstrates the characteristics of the teacher participants and the resources available in their classrooms.

Methods and Data Sources

A qualitative case study design (Yin, 1993) was employed in order to understand changes in teacher learning, practice, and leadership roles in the context of participation in the DWPti. Typical in case study research, data were collected from multiple sources that included surveys, interviews, observations, online postings (e.g., blog postings), and collection of artifacts.[6]

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[5] The other five participants were technology coordinators interested in learning more about the integration of technology in writing in order to help other teachers back in their schools. An informed decision was made to focus this research on classroom teachers in order to look at the impact of the DWPti on technology integration practices.

[6] The first author was also an instructor at the DWPti and was directly involved in the collection of data.

Table 1. DWPti Activities and Their Relationship to Key Principles
of Effective Professional Development (PD)

Principles of effective PD	DWPti activities
Focus on Teacher Knowledge (Content & Pedagogy)	a) Focus on teachers as writers b) Focus on technology applications specific to the teaching of writing (blogs, wikis, digital storytelling, various software applications, online databases) c) Study research on best practices in the integration of technology in writing d) Discuss integration strategies and purposes for using technology applications specific to writing.
Reform Type Activities	a) Collaborative group meetings, face-to-face and online, aligned with classroom practice b) Support community-building by providing ample opportunities to interact and provide feedback to colleagues, face-to-face and online c) Provide a blog as a place for sharing ideas, successes, and failures with colleagues d) Provide scheduled meeting times for teachers to instant message (IM) questions to the group for additional support during the summer and fall months
Situate Activities in Teacher Needs	a) Employ activities in multiple sites (university, teachers' classroom, online) b) Integrate teacher classroom material with PD activities c) Provide just-in time support through blog discussions
Active Learning	a) Model activities that teachers will implement in their own classrooms, such as using a blog, using a wiki, creating a digital story, and creating concept maps in Inspiration b) Classroom interactions on the program's blog through discussions, reflections, and postings c) Collaboratively compose an informative writing piece on the class wiki d) Create digital stories using Movie Maker 2 e) Have teachers design and implement a technology enhanced-lesson to support and extend the teaching of writing f) Have teachers use Inspiration as a pre-writing strategy for a required writing piece g) Foster reflective practice through blog discussions on successes and challenges in technology integration
Extensive Duration	a) Enact activities over 9 months to promote learning, sharing, and collaboration b) Used the blog and other online applications (Instant Messaging, E-mail) for sustained support c) Allow time to implement technology in the classroom and provide feedback

Table 1. (Cont'd.)

Principles of effective PD	DWPti activities
Collective Participation	a) Engage teachers from the same or near districts
Leadership Opportunities	a) Model and demonstrate technology implementation ideas to peers for feedback b) Develop and present a workshop to teachers and administrators across the state of Delaware (July-November) c) Present a workshop for principals in the state to promote upcoming DWPti workshops

Pre- and post-surveys[7] were used to assess teacher technological skills, beliefs toward technology, and implementation of technology in the classroom. Surveys were administered at the beginning of the DWPti (March 2005) and at the end of the summer institute (July 2005). Teachers recorded their technological competence and beliefs using a 5-point Likert scale.[8] Teachers recorded their technology implementation practices using the Levels of Technology Implementation (LoTI) continuum (Moersch, 1995). LoTI includes six levels of technology implementation ranging from non-use, to integration, expansion, and refinement. The primary reason for selecting LoTI over other continuums was teacher familiarity with the instrument. LoTI has been officially adopted by the state of Delaware as a tool to gauge technology integration efforts and, therefore, many teachers in the state are familiar with it.

Teacher interviews were conducted twice during the course of the study. Pre-interviews took place between the first and second meeting (before May). Post-interviews were conducted right after the end of the program (November 19-30). Each interview was approximately 40 minutes long. Al interviews were audio-taped and transcribed. The questions in the pre- and post-interviews were designed to access information relative to teachers' basic technology skills, integration of technology in the teaching of writing, beliefs and values regarding the use of technology in the teaching of writing, and leadership activities. The interview questions were developed to probe deeper than the survey questions.

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[7] The survey used in this study was developed and validated by the South-Central Regional Technology in Education Consortium. An additional component to the survey was added to measure the level of technology implementation exhibited by teachers.

[8] The technological competence Likert-scale ranged from 1 = need a lot of help to feel comfortable to 3 = moderately comfortable to 5 = expert level. The beliefs Likert-scale ranged from 1 = strongly disagree to 3 = undecided to 5 = strongly agree.

Table 2. Characteristics of Teacher Participants

Participants	Grade taught	Subject taught	Years of teaching experience	Overview of technology resources in school
Chloe	Second grade	All content areas	5	Two networked classroom computers; six alpha smarts; one laptop
Leah	Seventh grade	Science	9	One networked classroom computer; computer lab
Donna	First grade	All content areas	2	Five networked classroom computers; computer lab
Charlie	Fourth grade	All content areas	13	Four networked classroom computers; computer lab
George	Fourth grade	All content areas	3	Three networked classroom computers; six computers in a pod area; computer lab

Classroom observations elicited data related to: (a) the classroom environment; (b) technology resources available; (c) instructional focus; and (d) the role of the teacher, students, and technology used. Each teacher was observed once for approximately 90 minutes. All observations were conducted right after the end of the program in November (November 20-30). Each observation was followed by a short debriefing session with the teacher to ensure that the researcher understood the purpose of the activities. After each observation, notes were reconstructed into complete narrative summaries. Teachers read the summaries to verify the accuracy of the narratives.

Throughout their participation in the DWPti, all teachers used a blog to compose daily reflections, post questions, and participate in online discussions with their colleagues. In particular, teachers wrote a reflection after each face-to-face class meeting and throughout the six additional online program hours (August-November, 2005). Teachers were asked to reflect upon: (a) their learning for the day (after each face-to-face meeting); (b) the ways in which their professional practice influenced their learning; and (c) the impact of the interactions, discussion, and conversations with other participants on their learning. All teacher blog reflections, questions, and online discussion comments were collected for analysis.

Finally, a range of artifacts developed by teachers throughout their participation in the DWPti were collected. Teacher artifacts included blogs, assignments

for students, digital stories, and demonstration workshops. Figure 2 shows all data collection activities and their timing.

Data Analysis

Data from each source were analyzed using different strategies. Survey data were analyzed using descriptive statistics to illustrate changes in teacher technological competencies and beliefs. Interviews, observations, and online (blog) reflections and comments were analyzed using the constant comparison method that helped detect emergent themes (Lincoln & Guba, 1985). First, interview data were read repeatedly and a preliminary coding scheme was developed. The coding scheme was then applied to all interview data and several revisions were made. The final coding scheme included the following categories: (a) teacher knowledge (technology competence and pedagogical understanding); (b) teacher use of technology in the teaching of writing; (c) teacher beliefs; (d) leadership opportunities; and (e) perceptions on the value of professional development (DWPti). The final coding scheme was applied to all interview and online written data and a data analysis matrix was developed for each participant. The matrix documented teacher knowledge, use, beliefs, and leadership practices at two points in time (March 2005 and November 2005) as a way of facilitating comparisons.

As analysis for each individual teacher was completed, data were compared with those of other teachers to identify similarities and differences among the participants and detect themes that cut across all cases (Miles & Huberman, 1994). Other sources of evidence, such as observations and teacher artifacts, allowed the researchers to corroborate or dismiss emerging themes enhancing the validity of the findings (Maxwell, 1996; Oliver-Hoyo & Allen, 2006). To ensure accuracy, the second author independently applied the coding scheme into data from three teachers. All disagreements were resolved verbally and a consensus was reached.
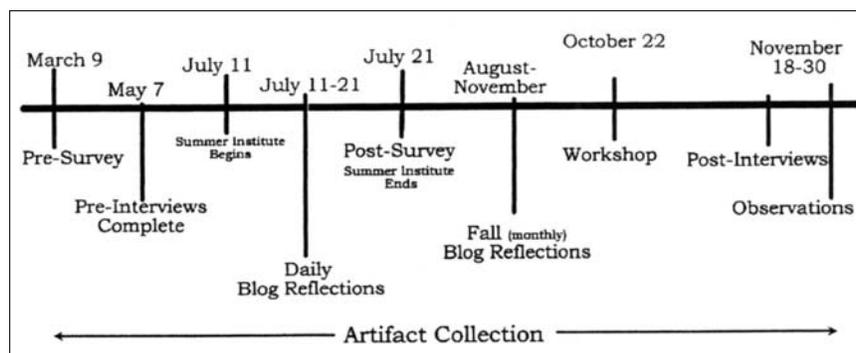

Figure 2. Timeline of data collection activities.

FINDINGS OF THE STUDY

Findings of the study indicated that the DWPti had a positive impact on four aspects of teacher learning: (a) acquisition of new knowledge, (b) application of technology into the teaching of writing, (c) beliefs toward using technology in writing, and (d) opportunities for exercising leadership skills. The major findings of the study are discussed below.

Acquisition of New Knowledge

Two aspects of teacher knowledge were highlighted in the study: technological competence (e.g., using blogs, wikis, digital storytelling, etc.) and use of technology for pedagogy (i.e., technology pedagogical content knowledge—TPCK). When they entered the DWPti, teachers felt comfortable with windows basic operations, word processing skills, Internet searches, e-mail applications, and multimedia software. As a result, the two-week summer technology institute focused on helping teachers acquire advanced skills in familiar applications (e.g., manipulating graphics in multimedia) in addition to focusing on new and unfamiliar skills that included learning how to use software such as Movie Maker 2 (for digital storytelling),[9] and online communication tools such as blogs and wikis.

Survey data demonstrated that teachers improved their technology competence in both familiar and unfamiliar software applications including increased learning in the use of blogs, wikis, and digital movies. Figure 3 illustrates changes in teacher technological competence over time.

In addition to improving teachers' technological competence, a major goal of the DWPti was to help teachers develop their TPCK—acquire an overall conception and understanding of how they can use a range of tools to support their teaching of writing. When teachers entered the DWPti, they were unable to articulate or envision specific examples of how technology tools beyond word processing could support their teaching of writing. In fact, when asked to provide specific examples of how multimedia production, blogs and wikis can support the writing process, most teachers responded that they did not know.

Findings of the study indicated that the DWPti helped teachers acquire an increased pedagogical understanding of how they can use multimedia, concept mapping software (e.g., Inspiration) as well as a range of electronic communication tools to support the teaching of writing. Specifically, in their post-interview responses all teachers communicated concrete examples of using such tools in the writing classroom. In addition, all teachers developed goals for the development of technology integrated lessons that they planned to implement in their classrooms following their participation in the DWPti. Charlie, characteristically noted:

[9] Windows Movie Maker 2 is a software used to create, edit, and share home movies.
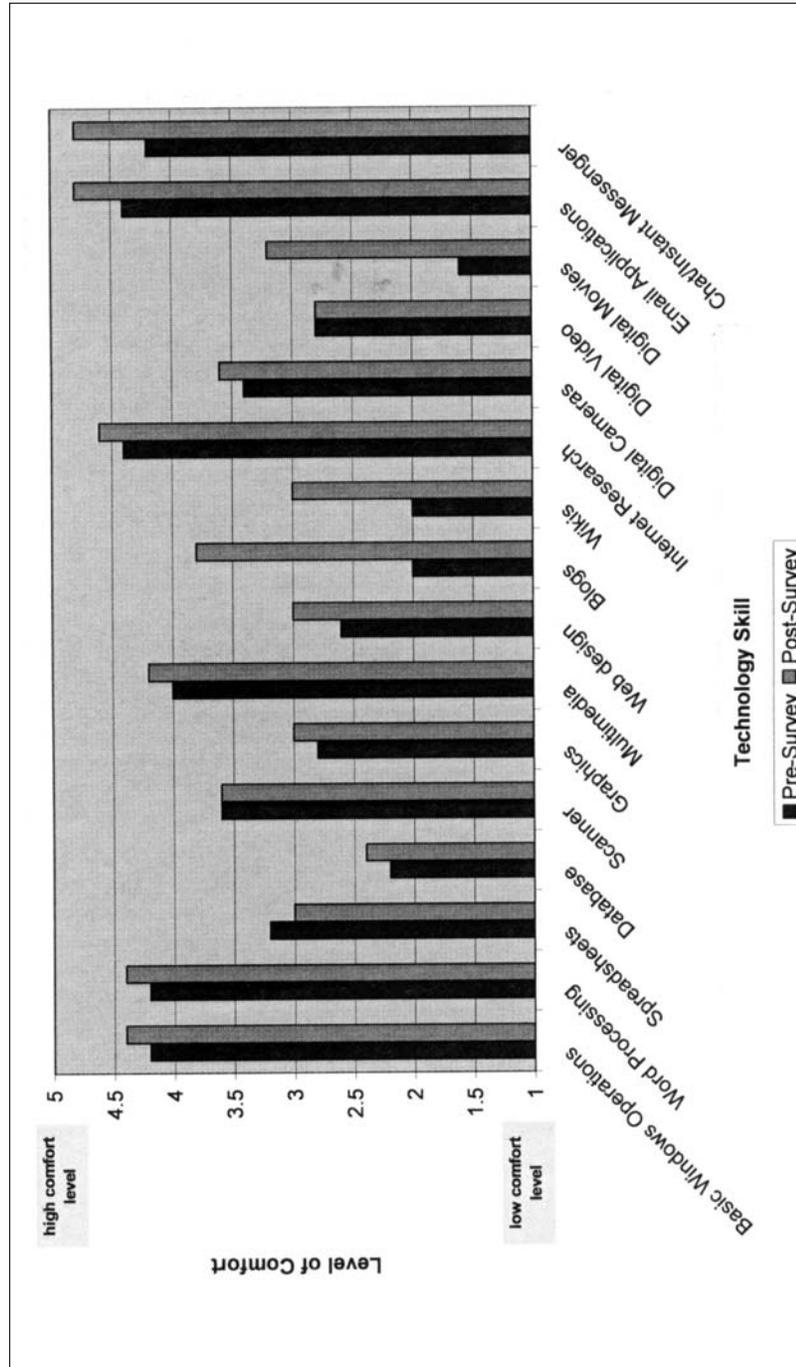
Figure 3. Teacher technological competence throughout participation in the DWPti.

> Participation in the DWPti has changed my thinking when it comes to technology integration. There are so many avenues to implement what I have learned and I plan on doing so. I will use wikis to teach editing. I will get my students to write precise and concise personal narratives using digital storytelling. I will also be creating another blog to integrate math and informative writing. These are just a few ideas; I am sure I will be using it in other ways. I have many creative new ideas now that I know how to use, implement, and integrate these tools (Post-interview, November 2005).

Donna reinforced these perceptions and provided examples of how the DWPti enhanced her understanding of using blogs and digital storytelling to support student learning. She noted:

> At the beginning of the project, I thought of blogs only as a response journal. But now I am beginning to see how it is a place to document your thoughts, reflect on what peers say, and communicate what you think. My head is also spinning with ideas about how digital storytelling will help me reinforce how small moments in life can be used to create powerful writing (Post-interview, November 2005).

Table 3 illustrates a growth in teachers' TPCK; it demonstrates a clear shift in teachers' understanding of using specific technologies to teach writing through direct quotes from pre- and post- interview data and blog reflections.

Application of Technology into the Teaching of Writing

1. Results from the LoTI Continuum

The major goal of the DWPti was to encourage instructional use of technology to support student learning of writing. Instructional use of technology is often categorized on a continuum. As discussed previously, this study employed the LoTI continuum as one measure of teachers' technology integration efforts. As with other continuums, the low end of LoTI (Level 1) represents little to no technology use while the high end (Levels 4B-6) signifies more innovative uses of technology (e.g., using technology to support higher-level thinking). Table 4 demonstrates self-reported data on the LoTI level exhibited by teachers before and after participation in the DWPti.

As demonstrated in Table 4, only two teachers (Donna and Charlie) progressed to a higher level of technology implementation after their participation in the DWPti while three teachers (Chloe, Leah, and George) remained at the same level. When asked to explain their thoughts on why their LoTI level had not changed throughout participation in the DWPti, these teachers indicated that they had initially overestimated their LoTI level. As a result, even though they had experienced growth in their technology integration practices, such growth was not reflected in their survey responses. George explained it best when he

Table 3. Teacher Pedagogical Understanding of Technology Integration
in Writing Before and After Participation in the DWPti

	Pre-interview (March 2005)	Post-interview (November 2005)
Chloe	I only foresee using computers as a word processor. I am not really sure what I could do with such technology.	I always publish a class book at the end of the year and I want to use digital storytelling to complete the final product.
Leah	Students often look at using the computer to type things up. But I would like it to be more than just that. I still have not figured out exactly how to accomplish my goal.	I am leaning toward using a wiki as a tool for practicing writing, where students would improve inferior pieces of writing or responses to various topics. I really like the feature of monitoring the evolution of content, including edits and changes over time.
Donna	Can this technology be integrated into my instruction to help students? I just do not know the answer.	I want to use digital storytelling because it is a powerful tool for students who have difficulty expressing themselves with words. It reinforces the idea that pictures need to be the starting point for all writing.
Charlie	If I am going to use technology, it cannot be an add-on to the curriculum; it has to fit into what I am doing, not take time away from my instruction. I have not been able to figure out how to do that yet.	I want to use a wiki for editing purposes in my class. I could have one piece for the class to write and edit, like a classroom story to collaborate together. Then students could go in and add, revise, edit. I have so many good ideas for integrating technology in writing now that I know how to use and implement these tools.
George	I have no idea how technology can be incorporated into my writing program.	Originally, I saw writing centered on grammar instruction. I now understand that writing is not a 45-minute class period but an experience occurring through the day for different purposes. I want to provide more writing experiences for the students and go beyond writing only for school purposes. As a result, Sue and I plan to use a wiki where students at our different schools will collaborate to write a fable this spring.

Table 4. Self-Reported Data on LoTI Levels of
Technology Integration

	Pre-survey	Post-survey
Chloe	3	3
Leah	4B	4B
Donna	3	4A
Charlie	2	4B
George	4A	4A

Levels	Description
Level 0	Non-Use: No visible evidence of computer access or instructional use.
Level 1	Awareness: Computers are used primarily for teacher productivity.
Level 2	Exploration: Technology-based tools generally supplement the existing instructional program and technology is used for lower cognitive tasks.
Level 3	Infusion: Tool-based applications are primarily used by students for analyzing data, making inferences, and drawing conclusions.
Level 4A	Integration (Mechanical): The use of outside resources and/or interventions aid the teacher in integrating technology-based tools that provide rich context for students' understanding of the pertinent concepts, themes, and processes.
Level 4B	Integration (Routine): Teachers can readily create level 4A Integrated units with little intervention from outside resources and technology is used to provide rich context for students' understanding of the pertinent concepts, themes, and processes.
Level 5	Expansion: Teachers actively elicit technology from outside entities to expand student experiences directed at problem-solving, issues resolution, and student action.
Level 6	Refinement: Computers provide a seamless and almost transparent medium for information queries, problem-solving, and/or product development.

noted: "In the past, I thought I used technology quite a bit and in a useful manner. Through my participation in the DWPti, I realized that I was using technology more for myself than for the students" (Post-interview, November 2005).

2. Results from Qualitative Data

Integration of technology into classroom practice was also assessed through in-depth interviews, observational data, blog reflections, and collection of artifacts. Findings from these data sources indicated increased use in teachers' application of technology into practice. Three teachers (Chloe, Leah, and Charlie) were able to use the tools introduced during the DWPti to design new and more powerful writing activities that encouraged students to share ideas with their peers, communicate experiences, and make writing public. Two teachers (Donna and George), on the other hand, primarily integrated the new tools in the context of existing activities rather than use their new knowledge to redesign their writing practice. These findings are not surprising; since teachers entered the DWPti with different beliefs and experiences in technology integration, it was only natural to depart the program through different exit points along the "technology into practice" continuum.

Donna and George: Integrating technology into existing activities—When they entered the DWPti, both Donna and George made very minimal use of technology because they believed that composing writing on the computer was detrimental to student learning. George noted characteristically: "I do not let my students type their rough drafts on the computers because I feel it takes away from their learning. I only allow them to type their final drafts and products" (Pre-interview, March 2005). By the end of the DWPti, George began implementing a range of technology tools in his classroom that allowed students to compose writing directly onto the computer. Instead of having students keep journal entries with notebooks and pencils, George implemented *Class Chatter*, a free Web log service for classroom teachers. Donna also made minimal use of technology in her classroom prior to her participation in the DWPti because she believed first graders were not capable of using such technology. As a result of her participation in the DWPti, Donna implemented tools such as Inspiration to help young writers with organizing their thoughts. These activities supported the writing process and represented a dramatic departure from earlier practices implemented by those teachers.

Chloe, Leah, and Charlie: Integrating technology to improve practice—As indicated, Chloe, Leah, and Charlie integrated the new tools in their classrooms to create powerful writing experiences for their students. The following narrative from Charlie is illustrative of those teachers' efforts to use technology as a way of writing for higher-order thinking, reflection, and communication. It also demonstrates Charlie's ability to apply new knowledge into practice.

Charlie: Applying new knowledge to improve practice. When Charlie entered the DWPti he explained that he primarily used technology to perform professional tasks or demonstrate something to students. In his pre-interview, he noted: "In the past, I used computers for e-mail, report cards, and practice assignments, but never really had my students use them in a meaningful way. I am the one normally using the available technology tools." Charlie also indicated that he viewed technology primarily as a motivator for his students rather than a central component in the teaching of writing.

Charlie believed that his level of implementation, according to the LoTI scale, mirrored level 2, the Exploration level. According to the LoTI framework, in this level, technology-based tools generally supplement the existing instructional program and technology is used for lower cognitive tasks (Moersch, 1995, 2001). In justifying his response to the corresponding LoTI level, Charlie admitted that he had difficulty implementing technology in his classroom to support student learning because of his need to be in control. He explained: "I think I am in level 2 because I am not ready to let the students take more initiatives with technology. I like to direct everything that takes place in the classroom" (Pre-interview, March 2005). Charlie reinforced this perception by explaining how he only selected certain technology activities in which he could control the situation. For example, prior to DWPti, Charlie's students only conducted Internet searches through pre-selected websites and researched teacher-specified questions. They were not allowed to come up with their own topics or research their own questions. Charlie acknowledged that he was not satisfied with this level of implementation and realized that he had to become more student-centered if he wanted to make more meaningful uses of technology.

Charlie's shift in understanding and practice took place throughout the duration of the DWPti. As he began acquiring a better understanding of how to apply technology in the teaching of writing, Charlie realized that his past use of computers limited students' experiences. Charlie's dissatisfaction with his earlier practices escalated when he learned about blogs and their ability to engage students in authentic online discussions. As a result, Charlie decided to integrate blogs into his writing classroom. By October 2005, Charlie completed the design of his classroom blog and published it online (see Figure 4 for the opening page of Charlie's blog). The blog enabled Charlie's students to discuss literature, write in response to lead questions, and improve their thinking, communication, and reflection skills. For example, after reading the book *Amazing Grace* by Mary Hoffman to the students, Charlie posted the question "*Is Grace really Amazing?*" to encourage writing for higher-order thinking (see Figure 5).

In documenting his experience on the implementation of the blog, Charlie described: "I showed my students the blog today. It was a teachable moment and the blog fit perfectly into the lesson" (Blog Reflection, 10/18/2005). According to Charlie, as soon as the blog became live, his students "began blogging like

Reading Reflections

To read without reflecting is like eating without digesting. Edmund Burke

FRIDAY, JULY 29, 2005

What's this blog all about?

Hey Kids,

This year we've been talking about what good readers do when they read. So far you know good readers think as they read. Good readers are also active readers. They make connections to themselves, other texts and the world. Good readers ask questions, too. There is a lot more that good readers do. We've just scratched the surface with our strategy studies. You will learn a lot more about good readers this year.

Because everyone doesn't get to share their thoughts about the literature we read every day, I thought we could blog about it. Using this blog we can continue our conversations. Isn't that great!

On this blog you will have the chance to share your thoughts about literature, read your classmates thoughts and respond to them. Think of this blog as a place to grow as a reader. Welcome to the blog. I hope you enjoy your experience this year. Happy blogging!

Links
- Home
- Netiquette
- Netiquette Comix
- Keyboarding Help
- Our Thoughts About Reading
- Amazing Grace
- TEA with MLK
- Gasazi

Previous Posts
- What's this blog all about?

Archives
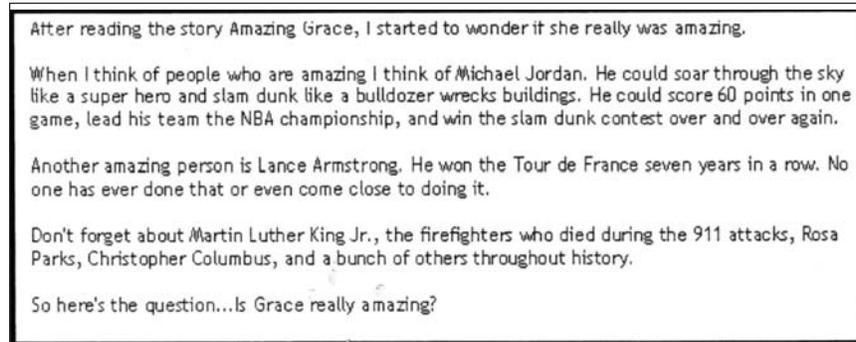- July 2005

Blogger

Figure 4. Charlie's classroom blog.

After reading the story Amazing Grace, I started to wonder if she really was amazing.

When I think of people who are amazing I think of Michael Jordan. He could soar through the sky like a super hero and slam dunk like a bulldozer wrecks buildings. He could score 60 points in one game, lead his team the NBA championship, and win the slam dunk contest over and over again.

Another amazing person is Lance Armstrong. He won the Tour de France seven years in a row. No one has ever done that or even come close to doing it.

Don't forget about Martin Luther King Jr., the firefighters who died during the 911 attacks, Rosa Parks, Christopher Columbus, and a bunch of others throughout history.

So here's the question...Is Grace really amazing?

Figure 5. Charlie's blog question on *Amazing Grace*.

crazy" with 240 responses within three days of the first assignment on the blog (Blog Reflection, 11/09/2005).

The success of Charlie's blog was a result of three important attributes related to the assignment: (a) the selection of the literature discussed on the blog; (b) the open-ended questions posted for each piece of literature; and (c) the way in which he modeled thinking and responding to his students. In his final blog reflection, Charlie wrote: "I used the blog to make writing experiences for my students rich and meaningful" (Blog Reflection, 11/17/2005).

During the post-survey and interview, Charlie believed that his LoTI level had improved from level 2 to level 4B, the Integration level. According to the LoTI framework, at level 4B, teachers can readily create level 4A Integrated units with little intervention from outside resources and technology is used to provide rich context for students' understanding of the pertinent concepts, themes, and processes (Moersch, 1995, 2001). Charlie's use of blogs, as described above, was well aligned with LoTI level 4B. Charlie used blogs to provide an authentic context for writing that helped enhance student understanding of literature while improving their own writing.

In addition to implementing technology in his classroom, Charlie also took time to reflect on its impact on student learning. He indicated, "I look at the results of using technology. How is technology impacting my students' learning? I am analyzing its deeper effect on students" (Blog Reflection, 11/17/2005). In this final reflection on the blog, he appeared very pleased with the results because he was able to observe "several nuggets of great thinking" on the blog. Charlie also discovered that students adopted a more collaborative writing stance, where they read and acknowledged their peers' thoughts and ideas. As he explained, use of blogs "had changed the ways in which students thought about writing" and had provided a more powerful learning experience.

Witnessing the powerful impact of technology on student learning, Charlie began re-evaluating his whole approach to the teaching of writing including his beliefs toward technology. As he noted, he learned "to step back and let the students take more control of the learning process." Charlie also became committed to the integration of technology in writing and created a teacher blog to facilitate an online book study among other fourth grade teachers and students.

Table 5 summarizes all teachers' instructional uses of technology throughout participation in the DWPti.

Beliefs on the Role of Technology in the Teaching of Writing

Findings of the study indicated that teachers entered the DWPti with positive beliefs towards using technology. Pre-survey data demonstrated that all teachers

Table 5. Teacher Integration of Technology in Writing

Teacher	Project
Chloe	*Language Arts:* Chloe's students participated in a class blog to discuss current events, write to communicate ideas, and share experiences.
Leah	*Science:* Leah implemented a blog for students to discuss science literature, lab results, and science topics. *Science:* Leah used Instant Messaging two nights per week to provide support to students as they worked on their homework.
Donna	*Language Arts:* Donna used Inspiration in her classroom to help young writers organize their thoughts. *Center Time:* Donna created a Technology Center in her classroom. Students reviewed technology vocabulary and experimented with technology to improve hand coordination and technical skills.
Charlie	*Language Arts:* Charlie designed a blog on *Blogger.com* to provide students with opportunities to discuss literature, reflect, and write in an online environment.
George	*Language Arts:* George's class wrote in Class Chatter, a blog space, to journal their thoughts. *Language Arts:* Students used Inspiration as a prewriting strategy.

considered computers as valuable tools that can improve education and accommodate different learning styles. In addition, pre-survey results indicated that most teachers acknowledged their responsibility to provide opportunities for students to use technology and believed that computers can influence student learning (see Figure 6). Interview data provided further insights into teachers' beliefs about the role and importance of computers in writing. During their pre-interview responses, for example, all teachers highlighted the motivational aspect of technology. Characteristically, across the five teacher pre-interviews, we counted thirteen instances where teachers referred to issues related to student motivation. For example, George noted in his first interview: "I think technology is a great way to get students to write. Everyday we encourage them to write and they are much more motivated to write with technology" (Pre-interview, March 2005).

Despite their seemingly positive attitude toward technology, however, teachers could not easily provide examples or evidence to justify their beliefs during their pre-interviews. In addition, when they were asked to discuss the role of technology in the teaching of writing, they demonstrated conflicting pedagogical views and focused primarily on disadvantages or concerns associated with the use of technology. Such concerns included time management, state testing pressure, student developmental readiness, lack of professional development, and lack of administrative support.

Post-interview responses and blog reflections collected at the end of the DWPti, indicated that teachers had broaden their perspectives on the role of technology in teaching and learning. As a result of the knowledge and experiences acquired through the professional development, teachers challenged previous beliefs regarding the role of computers in education and re-evaluated the advantages and disadvantages associated with the use of technology in the teaching of writing. Furthermore, post-interview data demonstrated that teachers exhibited more confidence in their beliefs regarding the use of technology and were able to provide specific examples to justify the importance of using computers in the writing classroom (see Table 6). The following vignette from George exemplifies the ways in which teachers discussed their beliefs toward technology throughout their participation in the DWPti.

George: Re-examination of beliefs. With only three years of teaching experience, George entered the DWPti because of his desire to learn more about technology. George started the pre-interview talking about the positive impact of technology on student motivation. He said: "I think technology is a great way to get students to write—that is a primary goal for me." As the pre-interview unfolded, however, George began to focus more on the ways in which technology interferes with writing. He mentioned word processing features such as grammar and spelling interfering with student learning. He articulated the belief that grammar and spelling are better learned through traditional methods of writing with paper and pencil. He noted:

> Composing on a computer is like learning to crawl before you can walk. I want them [students] to feel like they can do this on paper, because I think technology makes it easier for them (Pre-interview, March 2005).

Participation in the DWPti enabled George to learn about new tools appropriate for the teaching of writing and ways of integrating such tools to support student learning. Returning to the classroom in the fall of 2005, provided the time and context George needed to reflect on how he interpreted his use of technology. In a reflective entry on the blog he noted early in the fall: "I do feel that you [the instructor] may be accurate in the fact that I consider technology more of an extra than something to integrate into my teaching. I try to find ways to integrate it, but I feel I come up short, which in turns makes me frustrated" (Blog Reflection, 09/27/2005). This statement represented progress in George's beliefs on the role of technology in teaching. Instead of seeing technology as interfering with writing, George began to think of ways to integrate it into his practice.

Soon after George had his classroom computers' operating systems updated, he used blogs to have students keep journals online and discuss topics with their peers. Application of blogs into the writing classroom helped George reconsider his beliefs about the role and importance of technology in the teaching of writing. By October 2005, George commented: "I guess I did not really see that before, but technology does help students learn how to read and write. The implementation of the blog in my classroom made me see that clearly" (Blog Reflection, 11/28/2005). Seeing the benefits of technology for students helped George rethink his initial reservations about using computers in writing and begin planning more innovative projects for the future. Specifically, he discussed how he worked with a colleague from another school to plan an assignment where students could collaboratively write a fable using a wiki.

With a clear shift in his beliefs regarding technology, George used the computer more for teaching writing and less for administrative tasks. He also expressed a sincere desire to infuse technology in his teaching of writing. He stated:

> It intrigues me where we [my class and I, and all of us] can go with technology. I want to get past the mechanical stage and really implement and infuse technology into my teaching of writing. I am excited about the possible outcomes (Blog Reflection, 11/28/2005).

Table 6 illustrates ways in which other teachers re-evaluated their beliefs on the use of technology at the end of their participation in the DWPti.

Leadership Opportunities

An important goal of the DWPti, and all NWP sponsored professional development programs, was to prepare teachers for leadership roles. As part of this preparation, all NWP sponsored programs require teachers to develop a workshop they could present to their peers as a way of demonstrating their practices and
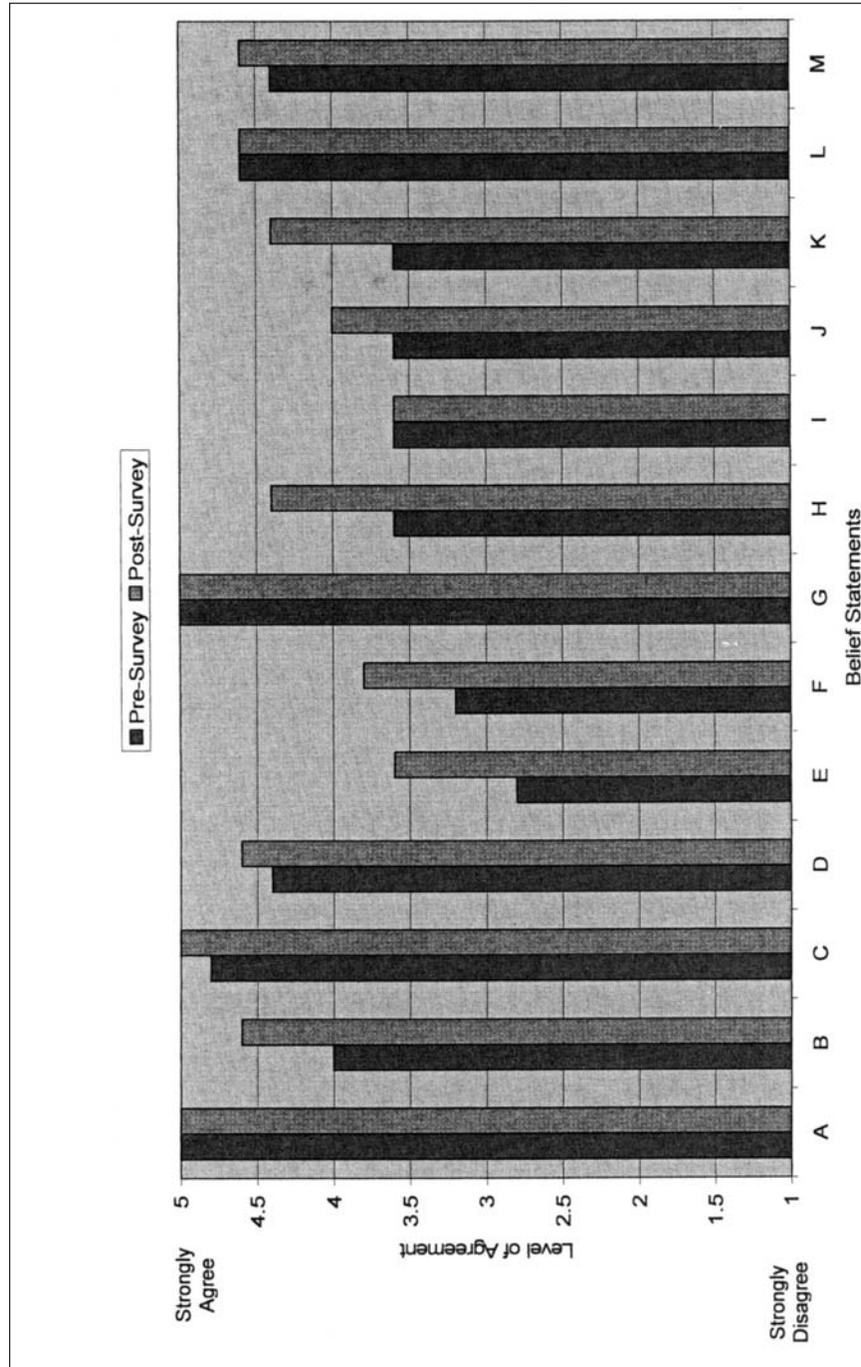
Belief Statements

A   Computers are valuable tools to improve the quality of education
B   I am a better teacher with computers in my classroom
C   Computers changed my life for the better
D   I enjoy teaching with technology
E   Textbooks will be replaced with e-media in 5 years
F   The role of teacher will be dramatically changed (due to technology) in 5 years
G   Technology can help accommodate different learning styles
H   I am a better teacher with technology
I   Students are better writers with technology
J   I need more training with technology
K   Student time is well spent on computers
L   My responsibility is to provide opportunities to use computers
M   Technology impacts student learning

Figure 6.   Teacher beliefs toward technology.

Table 6. Teacher Beliefs toward the Role of Technology in
the Teaching of Writing

Teacher	Illustrative pre-interview statements (March 2005)	Illustrative post-interview statements (November 2005)
Chloe	I believe the role of technology in writing is as a motivator.	Technology is the perfect fit into writing. Whether students blog or perform another activity, technology really lends itself because they learn how to write and think on the computer. Students are really conscious about what they write on the computer. They just keep revising and having conversations about their writing. Those are all essential elements of successful writers.
Leah	Right now the students often look up to me as I use my computer to type things up, which is a great way to use technology especially because their hand writing is usually horrible. I think technology should be a little bit more than that but I have not figured out exactly how to implement it yet.	Technology is a great writing tool because it allows students to quickly get their ideas down using an alternate format to the traditional paper and pencil. Students with grammar or spelling difficulties can use word processing tools to help correct mistakes. Inspiration allows students who may have difficulty writing to organize their thoughts. I have many more students participating in technology activities because they see the relevance and potential for it. Several students are carrying this over into other classes. The blog has been a huge success this year and I have few students that resist working on it. My students are better learners using the blog and I have seen increased participation, excitement, and performance.
Donna	I really think the computer can help writing since a lot of my students are more inclined to sit down and write on the computer as opposed to a piece of paper.	The other day, we went to the computer lab to have students share a learning experience in writing. Some students wrote so much more than I have ever seen or even expected them to write. Some students really got into making revisions: "Look, I spelled that wrong. I forgot my spacing." It was really amazing. The revision tool is helpful because they just do not see that in their paper and pencil writing. But on the computer, they recognize what they have done wrong. The computer is a great tool that gives them a good opportunity to reread and think of their writing.

Table 6. (Cont'd.)

Teacher	Illustrative pre-interview statements (March 2005)	Illustrative post-interview statements (November 2005)
Charlie	Technology sparks my students' interest to write more.	I really think that blogs have benefited my students. They have motivated my students to write, think out loud, have a voice, and write in a forum that does not fit the traditional mold of: introduction, body, and closing. It gives them a real audience; it is a real life experience with real people, something that I would have not been able to give my students in the classroom without technology. Technology has opened doors for different and more powerful writing experiences.

bringing new knowledge back to their schools. Following this established NWP practice, the DWPti required teachers to develop a workshop that focused on one aspect of technology integration in writing instruction. Teachers were expected to present their workshop to colleagues in their respective schools.

Designing a workshop appeared to be a daunting task for teachers because they did not have previous experience presenting new material to their colleagues or speaking to a wide audience. At the beginning of the DWPti, the online reflections often revolved around questions on this particular task. As teachers gradually became more comfortable with technology, experienced writing grounded in technology as learners, implemented their new skills in the classroom, and reconsidered their beliefs about the role and importance of computers in writing, they began exhibiting more confidence and excitement about presenting a workshop. By the end of the DWPti, all teachers successfully developed a workshop that they subsequently presented to teachers in their school and district, as well as to a state-wide conference, and in one instance, to a National conference. Furthermore, all workshops became part of the bank of workshops offered by the DWP for all schools and districts in the state. Table 7 provides a description of the workshops developed by DWPti participants.

Presenting a successful workshop empowered teachers and prompted them to seek further leadership opportunities in which they could share their newly acquired skills and knowledge in order to make a difference in their school. The following narrative from Leah, illustrates how participation in the DWPti provided teachers with a sense of empowerment and the ability to lead other teachers in learning new ways of integrating technology in the teaching of writing.

Leah: A new level of leadership. From the onset of the DWPti, Leah demonstrated the initiative to learn new ways of implementing technology to support students' scientific writing. Participation in the DWPti helped Leah increase her

Table 7. Description of Workshops Developed by
DWPti Participants

Teacher	Workshop description
Chloe	*Strategies that inspire:* Teachers will learn the basic features of the Inspiration software and how to integrate this writing software into the curriculum. Focusing on pre-writing strategies with technology will inspire students to become more creative and engaged in their writing. In addition, teachers will explore a variety of templates provided by Inspiration to find useful templates for immediate use in their classroom.
Leah	*Sci-blogs:* This course will help content area teachers find a way to integrate reading, writing and technology into their curriculum through the use of a blog. Teachers will review and explore a variety of blogs and brainstorm on appropriate places to use reading and writing in their course of study. The workshop will wrap up with teachers creating a blog based on their reflections and brainstorm results.
Donna	*Technology in the primary writing classroom:* In this presentation, K-1 teachers will discover ways to help their students begin to use computers through creative centers. Teachers will create hands-on activities to use in their classroom, such as computer mouse activities and paper keyboards to understand students' needs while typing.
Charlie	*Technology, comprehension, linking reading and writing:* Teachers will learn the basics of communicating on a blog and how this tool can promote thinking and literacy in the classroom. Teachers will view different classroom blogs, respond to literature on a blog, and create their own blog. Topics to be covered in the workshop include the reading-writing connection, responding to literature, and the social aspect of learning.
George	*Technology, expressive writing, writing across the curriculum, linking reading & writing:* This course will demonstrate blogs as an online journal. Teachers will review and explore Class Chatter, a blog Website for teachers and students. Teachers will learn how to create writing experiences for the students to respond and interact with each other. In addition, teachers will learn how to create writing opportunities that can be shared with an individual student and teacher.

understanding of technology integration. It also helped her implement electronic communication tools, such as blogs, to support the writing process in science and dramatically impact her students' learning. Leah's success with blogs traveled quickly throughout the state and as a result the *Delaware News Journal,* a local newspaper, interviewed Leah on how blogs impacted students' science learning. In her last interview, Leah noted on her success with blogs:

> The quiet students that I cannot get to say two words in the classroom now write volumes on the computer because they do not feel intimidated about being called out. They can sit there on their own and express their thoughts on the blog. It gives them a huge boost of confidence (Post-interview, November 2005).

Experiencing success with the use of blogs in her classroom created a sense of empowerment for Leah and an increased motivation to share her experience with other teachers. As a result, Leah often served as a mentor to her peers and advocated for the need to acquire more technology resources in her school. In addition, she submitted a proposal on the use of blogs in the science classroom that was accepted for presentation at the 2006 National Science Teachers' Association. In her final blog reflection, Leah explained how acquisition of new knowledge as a result of participation in the DWPti helped her become more respected in her school and assume more leadership roles. She wrote:

> Once I began reading the material of the DWPti program, I realized that my involvement in shaping how technology was used in my building/district was minimal, at best. This is because when we, as teachers, are asked our opinion on things regarding technology, we are heard but not really listened to. I realized that using examples from the research articles we studied and presenting myself as a knowledgeable teacher when making requests and suggestions, helped make my ideas more readily accepted; in the technology guru's eyes, I knew what I was talking about. As a result, I began lobbying for more technology resources in my school (Blog Reflection, 11/26/2005).

Table 8 summarizes all teachers' leadership activities throughout participation in the DWPti with associated comments on how the experience provided a sense of empowerment from post-interview data and final blog reflections.

THE PROCESS OF TEACHER LEARNING IN THE CONTEXT OF DWPti

Findings of the study indicated that participation in the DWPti influenced teacher knowledge, practices, and beliefs with regard to technology and provided opportunities to exercise leadership roles. Similar to findings from earlier studies on teacher learning (e.g., Mouza, 2006), results indicated that the process of acquiring new knowledge, practices, and beliefs followed a non-linear, interactive cycle (see Figure 7).

Table 8. Leadership Roles and Teacher Empowerment

Teacher	Leadership opportunities	Teacher comments on empowerment
Chloe	Created a workshop to teach other teachers and volunteered to conduct district-level technology workshops. Provided support to her grade-level team. Joined the school technology committee.	My biggest success was developing a real teacher workshop. To think I would have a workshop I could show other teachers in the state! You know? I have never shared more than one-on-one and now I have a workshop to present to a whole group. Now, I am on committees and I will be offering additional district workshops on technology.
Leah	Submitted a successful pro-posal to speak at a National Conference on the use of blogs. Interviewed with the News Journal on the use of blogs in her classroom. Provided technology support to her peers. Advocated a strategic plan for technology in her district.	For the other teachers to integrate literacy and technology, they have to see that it works. I can show that with mini-workshops during my department meetings to give them a taste of the possibilities technology offers in the realm of literacy. Through my learning here, I can pass these teaching tools onto more people and expose more students to technology.
Donna	Presented to faculty on ways to use Inspiration as a pre-writing activity. Demonstrated to her team how to create a blog. Presented the DWPti workshop to the entire school faculty.	I have gained an enormous amount of confidence in using technology. Sometimes, I feel empowered when I hear someone discussing blogs or digital storytelling. I want to jump in and say, "Hey I know a few things about that." It is a great feeling being the expert in my school.
Charlie	Demonstrated to other faculty how to create a blog. Created and led discussion on a blog for the school's Book Club. Selected to participate in the Delaware Technology con-ference on blogs in the writing classroom.	To be perfectly honest, this program intimidated me at first. I knew I could handle the work; it was the workshop that made me think twice. I had to get over my fear of public speaking. One thing I have found out through this experience is that when I know something really well, I can get up in front of anyone and talk about it. I think I have a winner with my workshop and I hope others can see the benefit of using technology with reading and writing.

Table 8. (Cont'd.)

| Teacher	Leadership opportunities	Teacher comments on empowerment
George	Presented to faculty how to use Kidspiration and Inspiration. Joined his school leadership team to develop technology professional development for faculty.	Before DWPti, I would not have volunteered to take on such a role—presenting technology. Now I see technology as a useful tool and I advocate for it.
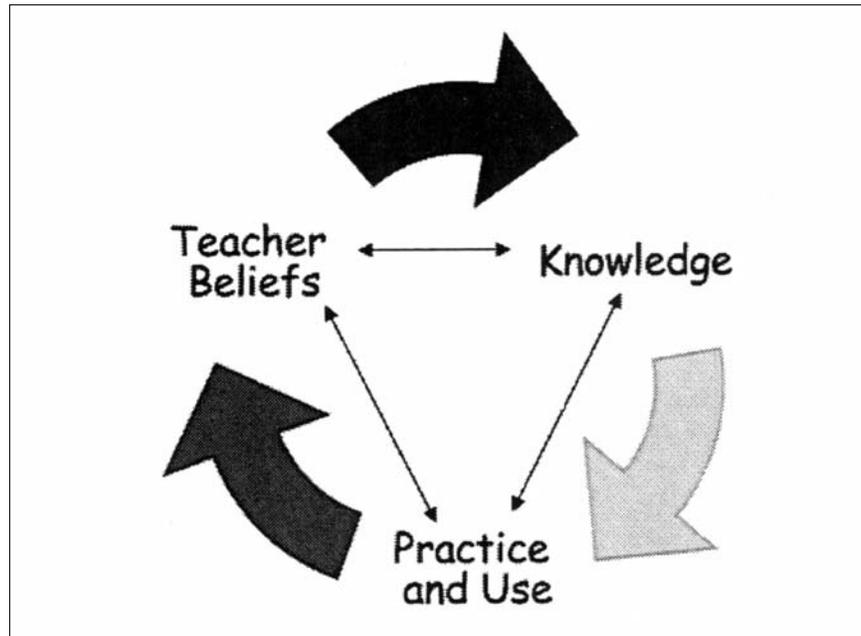
Figure 7. Teacher learning cycle.

As demonstrated in Figure 7, acquisition of new knowledge was critical to the implementation of technology in the teaching of writing. Teachers, however, did not always master new skills and pedagogical strategies prior to classroom implementation. In fact, after their initial implementation efforts in their classrooms, they returned to acquire more knowledge and skills during the follow-up meetings conducted in the fall of 2005. Consequently, enhanced knowledge and

individual experiences with technology integration in real classrooms prompted teachers to reconsider their beliefs toward technology.

It is important to note, however, that alterations in teacher beliefs proved to be the most resistant to change. The introduction of electronic communication tools such as blogs, in the teaching of writing, required teachers to not only rethink their beliefs about the role of technology, but to also reconsider their overall pedagogical beliefs associated with the teaching of writing (e.g., acknowledge writing as a social and collaborative process rather than an individualistic process). As a result, a final re-examination of beliefs did not occur until the end of the program when teachers saw clear benefits of technology (e.g., enhanced motivation to write, more authentic writing pieces, new ways of thinking about writing, etc.) in student outcomes. These findings are consistent with results reported by other researchers who found that shifts in beliefs occurred only as teachers began to see benefits of technology for both themselves and their students (Sandholtz, Ringstaff, & Dwyer, 1997). Re-examination of beliefs helped teachers become more committed to the integration of electronic communication tools in the writing classroom.[10] As a result, teachers began planning new projects that integrated writing and technology.

During their discussion of the role of the DWPti in learning, teachers seemed to mainly value four components of the program: extensive duration, multiple learning contexts, community support, and opportunities for leadership. In particular, teachers were pleased that they were given time to learn and implement new technological tools in their classrooms while receiving follow-up support through face-to-face meetings and online discussions. The actual implementation of electronic communication tools in their classrooms helped teachers enhance their understanding of using technology. It also helped them gather student evidence on the importance of technology in the teaching of writing. This finding lends support to an extensive body of literature on effective professional development that argues for the need to incorporate strategies that enable teachers to apply their new learning in the classroom (e.g., Guskey, 2003; Joyce & Showers, 2002; Klingner, 2004).

Teachers also valued the fact that the program provided them with multiple contexts for learning (e.g., university site, course blog, classroom). Charlie explained: "When I was blogging and using e-mail to communicate with my colleagues, I was also discovering what I really wanted my students to learn and experience. That was very valuable" (Post-interview, November 2005). This finding is consistent with recommendations echoed by other researchers who have urged educators to situate teacher learning in multiple contexts, both inside and outside the classroom (Putnam & Borko, 2000).

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[10] The examples provided earlier from Charlie and George, clearly illustrate the interactive relations among knowledge-practices-beliefs within the teacher learning cycle.

Consistent with current calls and efforts to situate teacher learning in communities (e.g., Barab, Kling, & Gray, 2005), teachers in this study also acknowledged the importance of their peers in their own learning. George noted: "I really enjoyed working with other teachers and being able to see what they were conducting in their classrooms. It made me realize the different perspectives we all contributed and the power we brought to the class" (Post-interview, November 25). Leah was equally enthusiastic about the community aspect of the program. In a blog reflection, she stated:

> I am saddened by the "end" of this professional development program but the experiences and knowledge shared by this small, yet adventurous group has really given me food for thought. We were all willing to take risks and share our failures, as well as our successes. This had a big impact on me (Blog Reflection, 11/26/05).

These responses indicate that social support from peers helped teachers in their exploration of technology and its role in the learning process.

Finally, teachers indicated that the leadership opportunities they were given as part of their participation in the DWPti had a tremendous impact on their sense of confidence and empowerment, which in turn influenced their efforts to use technology in their classrooms. Donna noted characteristically: "As a result of the increased leadership opportunities I was provided, I have gained an enormous amount of confidence in using technology" (Post-interview, November 2005). Figure 8 illustrates the recursive cycle of teacher learning and the four elements of DWPti that were most widely valued by teachers.

DISCUSSION

Findings of the study demonstrated that high-quality, content-focused technology professional development can influence teacher learning. As noted, however, not all teachers applied their learning into practice in equally powerful ways. Donna and George primarily integrated the new tools into existing practices rather than rethinking previous approaches to the teaching of writing. Findings from teacher interviews indicated that district policies, such as state-wide mandated testing and school contextual features, influenced the integration of technology in the teaching of writing. All teachers, for example, were under a lot of pressure from the high-stakes testing of the No Child Left Behind legislation (U.S. Department of Education, 2001) and some feared that the time consuming nature of technology integration may interfere with their instruction. George and Donna, in particular, feared that extensive use of technology may be a disservice to students. George explained: "I cannot let students who struggle with pencils only use computers for writing. They could do all the work on the computer and be totally fine but, unfortunately, they are not allowed to take tests on computers" (Pre-interview, March 2005). Donna reinforced this statement and indicated that
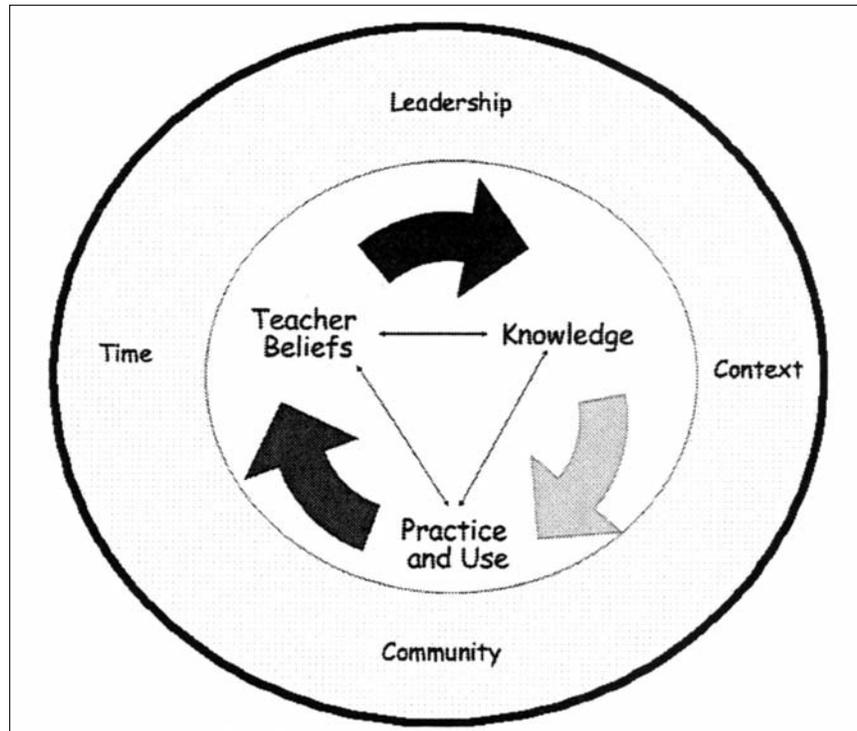
Figure 8. Teacher learning cycle in the context of the DWPti.

she would feel more comfortable integrating technology extensively into her writing if students were allowed to use computers during testing.

In addition to testing, all teachers struggled to reconcile new technology with the district's required curriculum and strict pacing guides—a prescriptive planning schedule often with suggestions for instruction. In particular, teachers explained that as a result of the pacing guides they had very little room for experimenting with technology in their classrooms, as such practices might result in falling behind the prescribed schedule. Concerns related to pacing were more prevalent for Donna and George, who were new teachers and their future as educators depended on their ability to follow the district policies.

Other researchers have also acknowledged the increased pressure placed upon teachers to cover prescribed curricula, as well as the central role of testing in their teaching, leaving little room for flexibility and innovation (Hoban, 2002; Meier, 2005). Zhao and Cziko (2001) contend that in order for teachers to widely adopt technology in their classrooms, they must first believe in its ability to help them meet a higher-level goal more effectively (e.g., student success with

testing) without causing disturbances to other higher-level goals (e.g., pacing guides). Results from this study clearly demonstrated that George and Donna were still concerned that technology may not necessarily help students succeed in tests, a goal of high priority to them, despite its positive impact on other aspects of student learning (e.g., enhanced motivation, collaboration, etc.). As a result, they had further difficulty transferring their learning extensively into practice.

Consistent with findings from earlier studies (e.g., Zhao & Cziko, 2001), a final challenge voiced by teachers was access to technology resources and technical support back at their schools. Most schools lacked the technology resources and flexibility needed to encourage implementation of computers into practice. Chloe, for example, had two outdated computers in her classroom. In addition, Chloe's students had a difficult time using the technology located in the school because their classroom was located in a temporary trailer that was not attached to the main building. Charlie also explained that waiting for the district support person to update the operating system on his classroom computers significantly delayed his efforts to implement a digital storytelling project. Although DWPti addressed strategies for using technology with a limited number of computers, teachers became frustrated with the lack of resources following the summer training.

CONCLUSION

Findings from this work demonstrated that developing teachers' ability to integrate knowledge of technology with knowledge of content and pedagogy is a complex process of negotiating previous pedagogical conceptions with new ideas and practices. Effective professional development must respect this complexity and find innovative ways of helping teachers develop their thinking and transfer their new learning into practice. Specifically, effective professional development needs to help teachers: (a) enhance their understanding of their subject matter with respect to technology; (b) increase their experience using technology (e.g., blogs, wikis) as learners; (c) improve their experience using technology in an instructional setting; (d) assume more leadership responsibilities within and outside their school boundaries; and (e) establish a sense of community that can support classroom implementation of technology. Use of electronic communication tools, such as blogs and wikis, represent promising means to creating innovative professional development contexts that foster community building and experimentation with newer types of technologies that can support the writing process.

The DWPti, discussed in this work, represented an innovative, research-based professional development experience that helped teachers improve their technological competence and understanding of technology integration in the teaching of writing. Teachers practiced new and creative ways in the teaching of writing, while improving the motivation and participation of their students. Furthermore,

the DWPti helped teachers challenge previously held beliefs and reconsider ideas on the role and importance of writing instruction grounded in technology. Finally, teachers assumed new leadership roles and gained a sense of empowerment.

Future implementations of the DWPti need to consider more systematic and concerted follow-up support as this often emerges as a critical factor for long-term professional growth. Furthermore, future research should investigate participants' learning over a longer period of time to document the ways in which teachers continue to learn and grow on the basis of what they have learned during formal participation in professional development programs.

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