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ABSTRACT

This paper summarizes Technology Integration Project efforts in four urban elementary schools that were involved in Professional Development Schools (PDSs). Project activities centered on: supporting the rooting of technology integration into school culture and teachers' efforts to integrate technology into their classrooms and strengthening the PDS partnership. Three factors were critical to the project: organizational strategies, professional development, and research activities. The Project emphasized teachers' ownership of their learning. Data collection involved participant interviews and surveys, classroom observations, and document review. Results found that the organization of the project supported teacher-driven learning and inquiry-based research. An inquiry approach strengthened teachers' involvement in the project and heightened the sophistication of technology integration. Ongoing and focused professional development supported teachers in designing and implementing classroom projects that integrated technology. The professional development provided teachers with the knowledge, capacity, skills, and confidence needed for project implementation in ways that were responsive to teacher learning needs. Overall, strategies implemented by the PDS Technology Integration Project increased technology integration and supported and strengthened PDS practices. (Contains 11 references.) (SM)

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Abstract

Since 1998, the District 3 Teachers College Professional Development School (PDS) partnership, the National Center for Restructuring Education, Schools and Teaching (NCREST), and The Center for Technology and School Change (CTSC) has engaged in a collaboration to develop and document a technology integration initiative that supports teachers to integrate technology into their classroom practice and root technology integration in the school culture. The Technology Integration Project (TIP) was developed in collaboration with the National Institute for Community Innovations (NICI) through a PT3 Challenge Grant.

Over the past five years, NCREST has documented the development of the TIP in four elementary schools. This paper is a summary of project aims and findings of the project. The project was both a development and research study in the integration of technology in urban, PDS elementary schools. Three factors were critical to the project: (1) organizational strategies, (2) professional development, and (3) research activities. We found that the organization of the project supported teacher-driven learning and inquiry-based research. An inquiry approach strengthened teachers' involvement in the project and heightened the sophistication of technology integration. Ongoing and focused professional development supported teachers in designing and implementing classroom curriculum projects that integrated technology. Most importantly, the professional development provided teachers with the knowledge, capacity, skills and confidence for project implementation in ways that were responsive to teacher learning needs. These findings have important policy implications for technology professional development. We end the paper with specific factors that are needed for successful technology integration initiatives.

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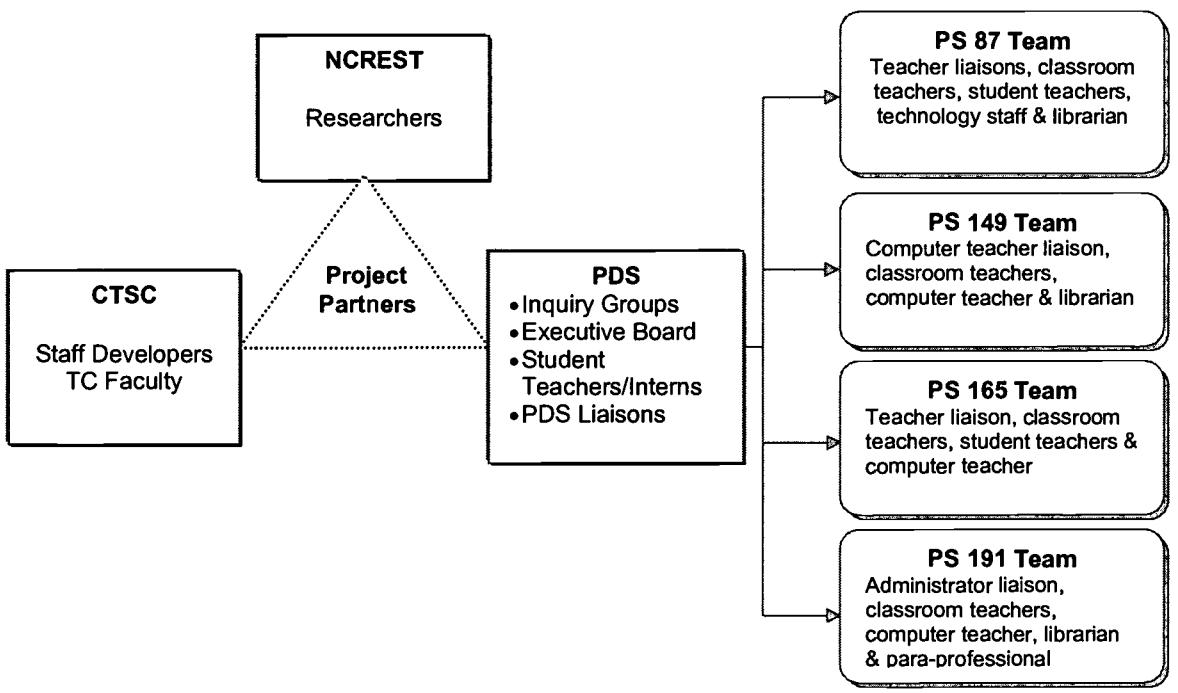
Introduction

The Technology Integration Project is a federally funded PT3 challenge grant aimed at helping teachers, schools, Professional Development School Partnerships (PDSs), and a university-based teacher education program integrate technology into curriculum and teaching practice for the purpose of enabling all students to achieve high performance standards. The project spanned from 1998-2003 and studied factors that facilitated and impeded technology integration in four urban PDS elementary schools. Teachers College PDS partners participated in the project, including: Teachers College faculty and students, four elementary schools in Community School Board District 3 (PS 87, 149, 165, 191), the National Center for Restructuring Education, Schools and Teaching (NCREST), and the Center for Technology and School Change (CTSC) (see figure 1). As stated earlier, this work is part of a federally funded grant awarded to NCREST by the National Institute for Community Innovations (NICI). Each partner

Figure 1

Project Partners



provided specific contributions to the project. For example, NICI disseminated up-to-date information and opportunities about technology and provided online tools for communication and research. The Teachers College PDS facilitated discussion and coordination among school and university staff. The CTSC provided targeted and sustained professional development in technology in a variety of formats, and NCREST documented and facilitated research efforts.

In this manner, all of the partners collaboratively achieved project goals. Project activities centered on three specific goals:

- to support the rooting of technology integration into the school culture;
- to support teachers' efforts to integrate technology in their classroom practice; and
- to strengthen the PDS Partnership

An important component of the project was teachers' ownership of their learning, and implementation of expanded learning opportunities for students through increased use of various technologies.

This paper is a summary of project aims and findings over five years of the project. The project was both a development and research study in the integration of technology in urban, PDS elementary schools. Three factors were critical to the project: (1) organizational strategies, (2) professional development, and (3) research activities. All three are discussed in detail followed by a discussion of research findings and final implications for creating and sustaining policy that supports student and teacher learning and increases technology integration and the preparation of teachers.

Organizational Strategies

The organization of the project supported teacher-driven learning and inquiry-based research. Inquiry into practice is a mechanism for schools to explore issues related to instruction and pedagogical philosophies of teaching and learning (Richardson, 1994). The Teachers College PDS has a tradition of engaging teacher educators in inquiry-based activities to improve teacher education. Inquiry groups is one of the staples of the PDS where student teachers, school staff and university partners gather to discuss and plan action research projects around practice and pedagogy (Darling-Hammond, 1994). These practices were a critical component of the Technology Project as school based teams (see figure 1) gathered to discuss effective strategies and mechanisms for integrating technology into curriculum and school structures.

Project participants were required to produce a project that integrated one or various technologies into classroom curricula. With the support of PDS partners and study group participants, teachers generated projects that infused technology into

classroom learning. Inquiry groups facilitated the sharing of knowledge, expertise and problem-solving techniques which increased technology integration at all of the sites. In this manner, teacher learning was contextualized within students' authentic needs; classroom realities; teachers' interests, strengths and technology integration capacities; and state and local performance standards and policies. This type of professional development represents a shift in research paradigms, from a quasi-experimental to an exploratory design where teachers and university researchers are collaboratively involved in the researching of best practices (Schon, 1983; Teitel, 1997).

In our study, we found that an inquiry approach strengthened teachers' involvement in the project and heightened the sophistication of technology integration. Teachers learned through active discovery at their own rate and according to their own needs and interests. This increased teacher participation and investment into project activities, and simultaneously, strengthened PDS activities. For example, decision-making processes increased at each site, allowing teachers to take active roles in developing their school's technology program. Study group participants were active in making purchasing decisions for the school and in shaping policies that impacted teacher and student learning goals in technology. They also made decisions about the nature of the projects and type of professional development needed for increased teacher and student learning. Consequently, teacher autonomy enhanced ownership and increased capacity for localized technology integration.

Making practice public was another essential ingredient of the project. National conferences and a PDS-wide celebratory event provided opportunities for project participants to publicly present and discuss their projects. More importantly, teacher work was validated by peers, supervisors and university faculty. From teachers' perspectives, this provided a forum to learn about their peers and each others' work in a professional learning community. From an administrative perspective, the event serves to increase accountability among school staff to learn and implement inquiry practices in their classroom. Both of these positions add to the instructional capacity of the school and PDS aims. Public presentations also promote a goal of the PDS – to advance collegial learning and sharing within and across schools. At this event, teacher learning was expanded beyond the classroom and was publicly shared among various constituents, making practice overt. Schools continue to struggle with this concept as practice remains a covert act, occurring within isolated classroom walls. Public display of practice is a means towards overcoming this dilemma and was championed throughout the project.

Professional Development

Another major component of the project is teacher-driven professional development. Ongoing and focused professional development supported teachers in designing and implementing classroom curriculum projects that integrated technology. Most importantly, the professional development provided teachers with the knowledge, capacity, skills and confidence for project implementation in ways that were responsive to teacher learning needs. Session formats were varied to accommodate the demands of classrooms and took the form of conferences, workshops, study groups and one-to-one

mentoring. Teachers learned through active discovery at their own rate and according to their own needs and interests. This type of professional development represents a shift from traditional one-shot workshops that pervade technology instruction and teacher training in general. Studies have proven the ineffectiveness of one-shot training in generating pedagogical and instructional change (Becker & Riel, 2000; Lieberman, 1996; Little, 1993). This study corroborated such findings as sustained and focused professional development proved effective in increasing teacher learning and technology integration.

A pivotal component of the partnership is participation in collegial inquiry groups. Teachers gathered on a monthly basis in study groups where they reflected on their practice, developed technology inquiry projects and publicly shared their learning. Group members shared examples of their projects (see appendix A and B) and collaboratively problem-solved issues and policies that impeded their progress. Some of these issues included: How to teach all students technical skills while having two to four computers in the classroom; How to organize students into groups; How to manage four students per computer; and How to save, find and close files. In particular, student learning, both of the technical skills and the concepts, was an important topic that produced rich conversations about teaching and learning. Questions that were asked included: Should students learn keyboarding?; Does the digital camera help students write?; Should we even use technology?; Why?; and When? Through such discussions, teachers developed inquiry projects that resolved pressing questions for their students and schools. In this manner, learning was contextualized to the needs of the classroom and the school.

Study group sessions also served as forums for teachers to gain new skills in technology, curriculum design and instruction. Staff developers from the Center for Technology and School Change (CTSC) at Teachers College met with individual teachers based on his/her preference and school schedule. During one-to-one or group sessions, teachers were introduced to technologies that built on and expanded their knowledge and interests. These technologies included: digital cameras, palm pilots, laptops, graphing tablets, virtual notepads, scanners, alphasmarts, the internet and various software applications. A district technology staff developer also attended study group meetings at two of the four participating schools. As a result, district and project professional development became more aligned. More importantly, collaborative policy-making processes emerged whereby project activities informed and shaped district policy.

Research

The purpose of our research was to study variables and conditions that facilitate and constrain the integration of technology in urban PDS elementary schools and university teacher education classroom curriculum. The goal of the research is to build a knowledge base at the school and university level about what helps teachers integrate technology into their classrooms. NCREST documentation is formative and participatory, serving to facilitate and shape project direction.

Project Participants

Four urban elementary PDS schools participated in the project. Participation was voluntary and participants were required to fulfill the following five components:

- attend a monthly study group
- participate in staff development
- create a technology-integration project
- present work in public forum
- participate in the research

Each school team was comprised of K-5 teachers, a computer lab teacher, Teachers College student teachers, a librarian, a paraprofessional or parent responsible for technology, and a school-based liaison responsible for coordinating project activities and communicating with the NCREST project staff (see figure 1). In year one, 35 teachers volunteered to participate in this project. Project participation doubled in the second year, and remained level for the remaining three years as schools experienced staff turnover. In the first year, most participants were novice technology users. Currently, participants are moderate to expert users of technology.

Methodology

NCREST followed a qualitative data collection approach whereby researchers interviewed participating teachers, student teachers, school administration and students; observed classrooms, professional development and study group sessions; surveyed project participants; and reviewed multiple documents.

Findings

The following section outlines specific findings for five years of the study that are meant to aid school administrators and staff, university faculty, and policy makers in designing effective professional development models for teacher preparation.

I. **Participation in the project brought resources into classrooms and professional development opportunities**. This included functioning hardware and equipment in the classroom; appropriate software, such as KidPix, ClarisWorks, HyperStudio; additional professional development, including conferences; additional time in the lab for themselves and their students; and leverage and pooling of resources.

II. **Technology was used to address student learning needs.**

1. **Student Motivation.** Teachers report student excitement and enthusiasm towards technology help students to surmount learning obstacles. For example, one teacher saw a striking improvement in an emergent reader with

a learning disability. Because technology was incorporated into the lessons, the student was motivated to learn and this helped him to actively engage in his learning and become a more fluent reader and writer.

2. **Learning Styles.** Computer equipment and multimedia software utilized addressed a range of students' learning styles (e.g., auditory, visual, and kinesthetic). Teachers also provided a wider repertoire of options for students to present their work. Students were able to present information and knowledge learned in a variety of ways (e.g., Hyperstudio stacks, Kidpix illustrations, imovies, charts and graphs, and audio recordings).

III. Specific conditions enhanced technology integration.

1. **Time in the school day and curriculum**. Technology integration increases when time is allocated to specifically work on technology projects within the school day and curriculum. Flexibility in schedules and school curriculum allowed classroom and computer teachers to incorporate technology into classroom learning such that it wasn't considered an "add-on." Effective coordination between computer lab and classroom schedules also increased technology integration.

2. **Time for teacher learning.** Additional time for professional development increased teacher learning. One-to-one staff development, as well as study group meetings and conferences, added to teachers' learning of technologies, which in turn, increased technology integration in classrooms. Novices to technology benefited from learning basic computer operations, such as opening, saving and organizing files and the learning of multimedia software applications such as Kidpix and Hyperstudio. Beginning teachers benefited from discussions with more experienced teachers on issues, such as classroom management and curriculum design. Teachers with advanced technical knowledge required additional time to learn the latest technologies.

3. **Functioning technical infrastructure**. A functioning technical infrastructure is fundamental to technology integration. Failure of internet connectivity, computer malfunctions and printing problems were factors that impeded technology integration. Such barriers are typical of dilapidated buildings and overworked technology teachers. Three of the four schools have a computer teacher and ancillary staff assigned to address school-wide technical concerns. Yet, with increased equipment and number of classrooms, schools are still learning how to adequately provide the level of service technology integration requires.

4. **Access.** Teacher and student learning opportunities were expanded when there was greater access to computers, particularly in the classroom. Regularly scheduled opportunities for computer lab time were essential in providing students and teachers with more experience with technology. In cases where students come from under resourced neighborhoods, school

classrooms and labs provided the only opportunity for students to learn and access various technologies. An efficiently run computer lab is critical in ensuring that all students and teachers have access to technology, which increased the capacity of the school and teachers to integrate technology into the curriculum.

5. **Classroom management skills.** Management of classroom computers requires that teachers learn new strategies to incorporate technology into their classroom. In particular, increased technology skills of students, student teachers, and para-professionals assisted classroom management, resolving minor technical problems without taking away time from teacher instruction. This was particularly true of classrooms with limited and low functioning computers. It was also true of classrooms that were utilizing new technologies, such as palm pilots.

6. **Small group and student-centered instruction.** Computers and other forms of technology are more effectively incorporated into project-based, student-centered and small group learning activities. Use of mobile technologies, such as palm pilots and alpha smarts, were maximized during small group activities. Production of imovies were integrated into classroom curriculum through designation of various roles, such as producers, writers, directors, etc. More so, curriculum that emerged from student interests encompassed the majority of learning activities in the classroom and the computer lab.

7. **Professional development.** Professional development offered opportunities for teachers to learn technical skills, and strategies to support instruction and student learning goals. Participants benefited most when professional development was driven by the learner (e.g., based on teacher interests, experience and skill level) and stimulated inquiry. One-to-one staff development provided ongoing and specialized support in designing and implementing technology-infused curriculum. Monthly study group sessions served as a forum for the sharing and discussing of curriculum and instructional ideas, and literature on uses of technology in schools. Attendance and presentations at national conferences also promoted teachers' learning of technology integration.

8. **Curricular goals and standards**. Project participation increased the capacity of schools to align technology with curriculum and student learning standards. Project participants collaboratively developed Information Technology plans that aided their school's technology programs. More informal goals were developed among grade levels by teachers who disseminated knowledge and ideas to fellow colleagues.

9. **Supportive leadership**. Leadership with a strong vision and plans to implement technology supports technology integration. Internal administrative and external supports facilitated teacher learning and

technology integration. Flexibility in schedules and access to equipment and the computer lab were critical internal supports. External networks and learning opportunities provided teachers with increased knowledge, which when disseminated to fellow colleagues, increased technology integration (Lieberman & Grolnick, 1996). In particular, the school-based liaison encompassed a critical leadership role as informant and disseminator of information between the university, administration and school staff. School-wide capacity increased when the liaison effectively coordinated teacher, school and PDS needs.

Conclusion

Given the special nature of PDS schools and the relation to its partners, we found that strategies implemented by the PDS Technology Integration Project increased technology integration and also supported and strengthened PDS practices. One of the goals of the project was to help integrate technology into the school culture such that it becomes institutionalized in the daily rituals of the school. This occurred through teachers developing inquiry projects which they constantly reflected upon and discussed with PDS partners and colleagues. Teacher learning was also facilitated through internal and external supports such as leadership, funding, links to external organizations and study groups. Lastly, teachers were accountable to sharing and presenting their work in public forums. All of these practices strengthened the PDS by employing organizational, research, and professional development strategies that were aligned with and promoted PDS activities.

Specific to technology, effective technology integration in PDS schools required attention to many interrelated and complex processes. In our research, we found that resources were needed to address student learning needs. This required specific conditions for integration to occur such as: time in the school day and curriculum, time for teacher learning, functioning technical infrastructure, access, classroom management skills, Small group and student-centered instruction, ongoing and focused professional development, curricular goals and standards, and supportive leadership.

Yet even if these conditions are present in a school's reform plan, this does not guarantee success. It is critical that district and state policy makers, as well as administrators and teachers, take into consideration the unique contexts of each school and classroom context when developing and implementing policies. In our study, we found that learning communities, habits of inquiry, and organizational structures were important to support technology integration and PDS activities, and required continuous revisiting because of the dynamic nature of schools and technology, (Cohen & Ball, 1999; Elmore & Fuhrman, 1994; Hargreaves & Bascia, 2000). Factors that continued to be influx every year were staff, equipment, connectivity, physical space, staff development and district funding. As participants engaged in ongoing learning community activities, relationships emerged which allowed them to revisit practice, learning expectations, and structures in a investigative and trusting environment. More

so, technology facilitated relationships among participating teachers and administrators who then became a critical mass that acted politically to obtain resources.

As schools vary in complexity, we hope future research in technology integration illuminates the contextual uniqueness of schools. In particular giving special attention to under resourced schools in order to document the fragility of effective models given these complexities, and also to provide schools with practical research will be useful for the design and implementation of effective technology integration in schools and classrooms. In particular, we would like to further explore district and state technology integration initiatives that foster practitioner and university collaborations. Considering the dynamic nature of technology and classroom complexities, we believe these collaborations are essential to bridging the knowledge gap about how to effectively use and prepare teachers for technology integrated curriculum.

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