Design of a Real Time Network for Teacher Collaboration

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Abstract

Among the issues facing k-12 teachers today, isolation and a lack of integrated professional development are two of the most common. Additionally, as the organizational constraints of a traditional school serve to sustain the image of teacher as independent artisan, research on teaching and learning strives to change this image to teacher as active member of a community of practice. To address this I have designed an easy to use interface for a network of whiteboards to connect every classroom and teacher work area in a school. Through this design, teacher professional development activities will be situated in each teacher's everyday activities. The design takes advantage of the modes of multitasking and communication that teachers have been using for years.

The Problem

Formal professional development opportunities for teachers are subject to many pressures. Teachers are traditionally faced with general workshops aimed at a general audience while they prefer individualized, authentic learning which they can implement immediately. Political issues within a school can determine which teachers participate in available opportunities. Within most school settings "who attends depends on the initiative of individual teachers, and on their relationship with school and district administrators, or their willingness to pay their own way" (CPRE 1995).

Teachers also feel the pressure of time when faced with taking advantage of a professional development opportunity. Most teacher learning takes up teachers' own time. Even when substitutes are provided during the school day so that teachers may participate, "teachers must first spend hours preparing lessons and directions for the substitute so quality instruction can continue in their absence" (Vojtek 1997). Public

pressure can also stifle teacher professional development. Even when teachers make time to take advantage of a professional development activity, "the public often perceives time for teacher learning during the work day as robbing students" (DOE 1994; Murphy 1997; Vojtek 1997). Also, teachers may choose to seek out opportunities on their own, but this process takes time and, in most cases, personal money.

A final pressure on most formal professional development activities is that teachers in attendance rarely find opportunities or valuable support for practical integration of new learning into their classrooms. According to a study conducted by the Department of Education, "new teaching strategies can require as much as 50 hours of instruction, practice and coaching before teachers become comfortable with them" (DOE 1994).

While formal professional development activities are subject to various pressures, opportunities for informal professional development among teachers are primarily subject to organizational constraints inherent in traditional schools. "There's no time for sharing. The only time teachers are ever together is lunch time" (Rosenholtz 1991). As a result of this isolation, teachers tend to operate under norms of self-reliance. "If others suffer few instructional problems, there is personal shame in admitting one's own" (Rosenholtz, 1991). Such lack of collaborative norms is felt most strongly by beginning teachers or teachers who are new to a particular school context. "Norms of self-reliance [seem] as implacable as a hurricane, shattering novices' humanitarian intent" (Rosenholtz, 1991). Inherent in the self-reliance norm is a lack of communication among teachers regarding best practices. "Even among exceedingly talented instructors, there is the problem that their talent is not passed on to others who could in turn become 'artists' in the design and

delivery of instruction" (Hannum and Briggs, 1982). Research indicates that shattering this norm is vital. "Improvement in teaching is a collective rather than individual enterprise, and that analysis, evaluation, and experimentation in concert with colleagues are conditions under which teachers improve instructionally" (Rosenholtz, 1991).

The Solution

"Almost every approach to school reform requires teachers to refocus their roles, responsibilities, and opportunities - and, as a result, to acquire new knowledge and skills" (CPRE 1995). This solution to the problem of inadequate teacher professional development seeks to refocus teacher roles by drawing on existing teacher skills of communicating with students via chalkboard or overhead projector and of multi-tasking in a classroom full of students. A system of networked whiteboards in each classroom, office, and teacher work area within a school would facilitate both formal and informal professional development in an authentic manner. These whiteboards would be outfitted with an interface designed especially for use by teachers to facilitate communication, to encourage collaboration, and to scaffold teacher professional development activities situated in the classroom or school as a whole.

This design seeks to change the traditional culture of schools to make teacher collaboration, integrated professional development, and use of technology commonplace while calling upon familiar teacher communication norms. On the classroom level the networked whiteboard system hopes to shatter norms of self-reliance and shame in asking questions by taking advantage of a public venue. The electronic network of whiteboards allows teachers a voice outside of their classroom in ways like never before. Additionally

this system provides space for virtual meetings, as well as valuable technical support for face-to-face meetings.

The whiteboard design takes advantage of the natural modes of communication already occurring in schools. Since teachers' use of chalkboards is second nature when communicating with students, it seems only natural to employ a similar model when asking them to communicate with peers. Keeping in mind the teachers as users, this system is designed in an open manner to allow customization for any level of technological proficiency. For example a novice can use the default settings for complete and easy use whereas an expert can choose to modify the interface, install additional input devices, or add more complex applications. Also, to help any technophobes in their adoption of this tool, both layout and jargon which are strongly associated with computing have been discarded in favor of more descriptive and less loaded terminology. Finally, in keeping with the needs of the users, a system administrator function has been greatly reduced from typical systems, only holding basic fundamental control. If teachers view this system as a tool in which an administrator can track their communications they will not feel comfortable in using it, therefore, an administrator is only needed to enter user names into the internal clock and calendar.

Besides the obvious venue for synchronous and asynchronous communications among work areas, the electronic whiteboards also have powerful secondary uses within the school. Electronic boards are already helping with necessary tasks such as idea generation and note taking during face-to-face group meetings of teachers or students. With the networked capabilities, other tasks like distribution of information can also be carried out by the whiteboard. Another wonderful secondary feature is the modeling

which will occur throughout the school. Not only will teachers be able to model best practices for each other via the whiteboards, but they will also be engaged in modeling to benefit the students (Shulman, 1999). The students will see teachers constantly learning, working together and asking questions of each other, the benefits of which are invaluable. According to one administrator, "I strongly urge teachers to tell their students what they do and what they learn in study groups. The day after a study group meets is a great learning opportunity for students. Teachers often say, 'Today, we are going to do something that I learned in my study group yesterday.' Students go home and tell their parents. Parents see the connection, and the idea of how students benefit when more time is allocated for teacher learning is no longer an abstract concept" (Murphy, 1997).

Although this system has not been designed for a particular hardware system and is intended to interface with any whiteboard system capable of networking, the design does take many cues from the Tegrity System. The basic Tegrity setup allows any whiteboard to become electronic by employing a personal computer, projector, and camera. This system would become networked by tapping into the available local area network resources already existing in many buildings as a result of federal and state funding initiatives regarding public school connectivity. As they draw on LAN resources, the whiteboards will increase in functionality with added capabilities such as shared file systems, Internet access, or dial in access from off site. This design is not meant to replace current technologies being used in schools, such as email, but rather to work in concert with other technologies by offering different functionalities. For example, a teacher can take advantage of the whiteboard system to request a meeting with a school

counselor, but communicates details of her concerns regarding a specific student through a confidential email.

Communities of Practice and Situated Learning

As teachers use their whiteboards to work with each other, they will be creating a large body of collective knowledge in a school that was once filled with isolated individuals (Roschelle, 1995). In research on the social organization of teaching, Susan Rosenholtz (1991) found that "when collaborative norms undergird achievement-oriented groups, they bring new ideas, fresh ways of looking as things, and a stock of collective knowledge that is more fruitful than any one person's working alone." The whiteboard system will create a community among teachers which will evolve into a fully functioning community of practice.

A community of practice centers on "the idea that learning is constituted through the sharing or purposeful, patterned activity" (Lave & Wenger, 1989). Such a community of practice begins with coordinated use of tools in order to share experiences and devise resolutions (Roschelle, 1995). Other features might include "collective problem solving, displaying multiple roles, confronting ineffective strategies and misconceptions, and providing collaborative work skills" (Brown, Collins & Duguid, 1989). Constant discussion and reflection tie these threads of community together thus creating a collective intelligence among the practitioners (Brown, Collins & Duguid, 1989). "New roles [teacher leader, peer advisor, teacher researcher] and support structures for teachers help establish a professional culture in schools that generates ongoing development and continuous improvement. Gradually, learning together becomes expected behavior; time for teacher learning gains more prominence in scheduling. Teachers expect to be studying

some aspect of practice, comparing notes on implementation, and seeking new ideas or programs--and their working arrangements increasingly accommodate these activities. Formerly mundane activities become opportunities for learning and reflection" (CPRE, 1995). As a result of the burgeoning community of practice, teachers will take on various roles with differing levels of participation in the community of practice within their school (Lave & Wenger, 1989).

Situated learning occurs within a community of practice. This theory offers the perspective that learning in isolation is not the most effective way to develop knowledge and understanding. According to Brown, Collins & Duguid (1989), activities serve to situate learning and cognition: "a concept, for example, will continually evolve with each new occasion of use, because new situations, negotiations, and activities inevitably recast it in a new, more densely textured form. So a concept, like the meaning of a word, is always under construction." As a result of these renegotiations, narratives are created which increase the collective knowledge of all members of the community. Teachers, like any other learners, "must be actively involved in learning and must have opportunities to discuss, reflect upon, try out, hone better instructional approaches. Professional development strategies also must take into account the importance of support and the time required to implement improvement" (CPRE, 1995). To achieve these ends, the means of teacher professional development must reside in situated learning within a community of practice. According to Darling-Hammond and McLaughlin (1995), "teachers need professional development that extends far beyond the one-shot workshop; they need opportunities to learn how to question, analyze, and change instruction to teach challenging content." The National Staff Development Council (1999) has also adopted

the stance of situated learning in their call for teacher professional development to be "embedded in teachers' daily work and more closely linked to improving student learning." Situating continued teacher learning in the classroom "may be the first real step towards higher standards for all children" (CPRE, 1995) and can occur with the whiteboard network.

Cognitive Apprenticeship

Cognitive apprenticeship is one way to initiate learners into authentic practices through activity and social interaction and is an important part of situated learning within a community of practice. This idea has roots in the successful methods employed in craft apprenticeship. "Apprenticeship and coaching in a domain begin by providing modeling in situ and scaffolding for students to get started in an authentic activity. As the students gain more self-confidence and control, they move into a more autonomous phase of collaborative learning where they begin to participate consciously in the culture" (Brown, Collins & Duguid, 1989).

Within the design of the whiteboard network, teachers can take on varying levels of cognitive apprenticeship. Professional development templates, part of the design, will provide scaffolding for teachers in their learning. These templates may include, but are not limited to, book groups, goal setting, group development activities, portfolio creation, inquiry or active research, pre and post workshop activities, project management, peer review, team planning, and the National Board of Professional Teaching Standards certification process. Teachers may select a template to scaffold their learning or may develop their own templates as their apprenticeship role in the community evolves.

Collaborative and Calm Technologies

This solution is specifically designed as a collaborative technology. Jeremy Roschelle (1995) posits that "a collaborative technology can be defined in reference to a more encompassing and powerful goal: the construction of communal ways of seeing, acting, and knowing. A collaborative technology is a tool that enables individuals to jointly engage in active production of shared knowledge. . . Shared practices of collaborative technology use builds communal understanding." Through collaborative technologies, users can extend a shared experience into one which can become a part of the workings of an entire community. As a part of these shared experiences, the collaborative technology takes on a highly visible role and becomes "an instrument of mutual knowledge construction for a group of people. It is through the skillful deployment of collaborative technologies that communities of practices can grow and learn" (Roschelle 1995).

The use of whiteboards also draws on the idea of calm technology. Weiser and Brown (1995) explain that "designs that encalm and inform meet two human needs not usually met together. Information technology is more often the enemy of calm. Pagers, cellphones, newservices, the World-Wide-Web, email, TV, and radio bombard us frenetically." Calm technology works within a typical multi-tasking paradigm by moving "easily from the periphery of our attention, to the center, and back" (Weiser & Brown, 1995). Calm technology is designed to calm and inform by giving the user control to move the focus easily from her periphery to her center of attention. Teachers constantly negotiate between the center and periphery of their attention. For example, a teacher may be helping one student at his desk but still notice another student's frustration. This

teacher can switch her focus between the two students to best communicate with both in practically a simultaneous way. Calm technology works within this typical teacher paradigm.

Since humans have the ability to see large amounts of data and also the ability to focus on small pieces of that data, calm technology makes the most of the space around a user (Winograd, 1998). By making the most of the periphery, a user can attune to more things than if everything demanded to be in the center. Also, the control that the user exerts to center and recenter technology makes a powerful and calming experience for the user. This design takes advantage of the calming effects of allowing users to attune to more things than if everything had to be at the center and of allowing users to recenter something from periphery to center in order to take control of it. Through calm technology design, the whiteboards place the user in control of the environment rather than vice versa. Furthermore, Weiser and Brown's (1995) position on human empowerment is supported by teaching which focuses on social interactions. The design of calm technology is a fantastic step toward integrating technology into education without losing that vital human touch (Weiser & Brown, 1995).

Ubiquitous Computing

This design strives to follow the principle of ubiquitous computing (Weiser, 1996). The design of a system based on whiteboards is based on the most natural and universal classroom tool, the blackboard. As far as the users know, they are simply interacting with a blackboard with some terrific added functionality. The primary principle of ubiquitous computing is explained as "a less-traveled path . . . the 'invisible'; its highest ideal is to make a computer so imbedded, so fitting, so natural, that we use it

without even thinking about it . . . we [Xerox PARC] believe that people live through their practices and tacit knowledge so that the most powerful things are those that are effectively invisible in use" (Weiser 1996). The future that Marc Weiser describes is a place in which computers inhabit most things.

Furthermore, Weiser believes that rather than interacting with computers, users must dwell with them. His semantic choice implies that computers "have their place, and we ours, and we co-exist comfortably." These ubiquitous computers "will provide us with constant clues about our environment, . . . our own past, the objects around us and the world beyond our home. Computers will act like books, windows, walks around the block, phone calls. . . They won't replace these, but augment them, make them easier, more fun" (Weiser, 1996). The idea of ubiquitous computing relies also on the idea that freeing our minds from tedious, work-related details will lead us to deeper understandings. "It is commonly believed that thinking makes one smart. But it's frequently the opposite: in many situations, the less you have to think about the smarter you are. Who's smarter, the beginning piano student who thinks about each note, or the artist who thinks about the music and lets the notes take care of themselves? The expert can think about *less* because long practice has made it unnecessary to attend to the details" (Weiser, 1996). As computers become ubiquitous in teachers' lives in the form of interconnected whiteboards, the teachers can become more expert in their work.

User-centered Design

User-centered design is a process in which the intended users play a valuable role in the design process. Don Norman (1988) provides a list of basic principles for user-centered design which help the designer to create a clear interface for her users. Norman

insists that designers make the most of given constraints, strive for visibility, provide feedback for users, and rely on natural mapping. By paying attention to these principles, designers will make their systems easier and more pleasant for the user. Many times though, designers are not able to make every design choice in favor of the user and, according to Norman (1988), must make tradeoffs among features and constraints.

One of the key elements of this system is that it was developed through a user-centered design process. Besides drawing on personal experiences as a teacher and an observer of teachers, user studies were conducted. According to Don Norman (1988), designers should develop a conceptual model based on "knowledge in the world and knowledge in the head" (Norman, 1988), paying particular attention that the model's knowledge matches that of its users. To insure this match I conducted surveys with teachers regarding professional development, worked with a focus group of educators and designers to develop features, researched school environments through observation, and traced teacher communication via chalkboards. These user studies helped to drive the design.

Areas for Future Work

I hope to see this design more fully realized in the near future. According to Roy Pea (1999), "There is a feeling that some version of [this] vision would provide a practical, innovative, and research-informed framework for augmenting a teacher's intelligence." Currently, only the beginnings of an interface design exist. Next steps would be to continue work on features of the interface and continue research into similar solutions taking into account how this product would fit into the collection of

technologies that are available to teachers. Another next step is to build a prototype and conduct further user studies.

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More Information

More information regarding this design including initial user studies and storyboarding of the interface design can be found on the web at: http://ccwf.cc.utexas.edu/~cglazer/rtn.htm. Additional information on the Tegrity System can be found on the web at: http://www.tegrity.com.

References

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher 18(1): 32-42.

Consortium for Policy Research in Education (CPRE). (1995). Helping Teachers Teach Well: Transforming Professional Development. U.S. Dept. of Education. [Online] Available: http://www.ed.gov/pubs/CPRE/t61/

Darling-Hammond, L. & McLaughlin, M. W. (1995). Policies that support professional development in an era of reform. Phi Delta Kappan. 76(8).

Lave, J. & Wenger, E. (1989). Situated Learning: Legitimate peripheral participation (Report No. IRL-89-0013). Palo Alto, CA: Institute for Research on Learning.

Murphy, C. (1997). Finding Time for Faculties to Study Together. Journal of Staff Development. NSDC. [Online] Available: http://www.nsdc.org/library/jsd/jsdsm97murp.html

Norman, D. (1988). The Design of Everyday Things. New York: Doubleday.

Pea, R. (1999). Review of Learning Design and Technology Projects. Stanford University. Palo Alto, CA.

Roschelle, J. (1995). What Should Collaborative Technology Be? A Perspective From Dewey and Situated Learning. CSCL. [Online]. Available: http://www-cscl95.indiana.edu/cscl95/outlook/39_roschelle.html

Rosenholtz, S. (1991). Teachers' Workplace: The Social Organization of Schools. Teachers College Press.

Shulman, L. (1999). The Scholarship of Teaching for Meaningful Learning. Keynote Address. Center for Innovative Learning Technologies (CILT) Conference. San Jose, CA.

U.S. Dept of Education (DOE). (1994). Dimensions of the Time Challenge. Prisoners of Time. [Online] Available: http://www.ed.gov/pubs/PrisonersOfTime/Dimensions.html

Vojtek, R. & Vojtek, R. (1997). Technology in Staff Development: Using Technology to Emancipate Time. Journal of Staff Development. NSDC. [Online] Available: http://www.nsdc.org/library/jsd/jsdsm97voj.html

Weiser, M. & Brown, J.S. (1995). Designing Calm Technology. Xerox PARC. [Online]. Available: http://www.ubiq.com/hypertext/weiser/calmtech/calmtech.htm

Weiser, M. (1996). Open House. Review. Tisch School of the Arts. New York University. [Online]. Available: http://www.itp.tsoa.nyu.edu/~review/current/focus2/open00.html

Weiser, M. (1996). Ubiquitous Computing. [Online]. Available: http://www.ubiq.com/hypertext/weiser/UbiHome.html

Winograd, T. (1998). Topic 7: Control Design. Lecture for CS147 course. Stanford University.