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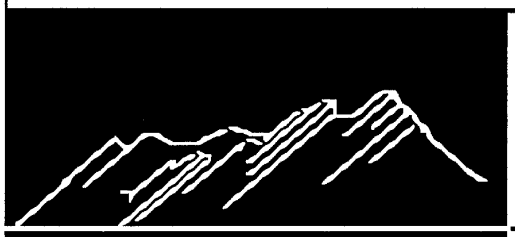

Technical Report

University of Colorado, Boulder

# Teachers Crafting Their Own Professional Development for Educational Technology: The Working Shops Model

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Running Head: THE WORKING SHOPS MODEL

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## Abstract

A model of teacher professional development for educational technology is described and results with the staff of a small high school are reported. The approach, termed Working Shops (WS), emphasizes teacher control, collaboration with peers and outside experts (cognitive scientists, computer scientists, content specialists, experts in curriculum and pedagogy), and time to achieve individual and institutional goals during the regular school workday and throughout the school year. Working Shops recast professional development (PD) by emphasizing a process of continual, contextual doing and producing. Beginning with shared goals and resources, participants formed project teams that operated as communities of practice. The participating teachers (n = 25) began with relatively low technology skills and comfort. During the WS program, they developed relevant and sophisticated projects that impacted their instruction, the way teachers prepared for classes, how they performed service to the school, and the nature of support given to students and parents during post-secondary counseling. Technology skills were reported to improve, as did comfort with technology and the sense of collegiality among the staff. The WS approach extended beyond technology to other areas of curriculum development and structures for establishing norms for written communication and intra- and inter-personal interactions in the school community. This approach shows that teachers can effectively and enthusiastically direct their own professional development, and may do so in a way that is more valuable to the school than traditional in-service workshops. The potential for extending this model to other schools and to the level of school districts is explored.

# Teachers Crafting Their Own Professional Development for Educational Technology: The Working Shops Model

Teachers are at the heart of successful innovation in educational practice (Archer, 1997; Rényl, 1996). But to participate meaningfully in the process of reform, teachers must continually learn (ECS, 1998; Fullan & Miles, 1992; Grant, 1996; Kleiman & Johnson, 1998; Peterson et al., 1996 AERJ). They need to master innovative media and teaching methods, apply and assess the effectiveness of these innovations in various learning situations, and, in light of these experiences, rethink how to approach the processes of teaching and learning. For example, In the area of educational technology, it has been reported that the number of computers in the classroom continues to increase in all sectors of society (e.g., government, business, and academia), but a major discrepancy exists between the level of technology use expected of K-12 educators and the actual use of technology in the classroom and integration with current curricula (Fabry and Higgs, 1997; ROSEN, & WEIL, 1995).

Not surprisingly, professional development for teachers has become an increasingly important subject in recent years for researchers and educational leaders (Kleiman & Johnson, 1998), especially as part of the effort to integrate technological tools into the daily practices of teachers (Grant, 1996; PCAST, 1997). Despite the increased attention, however, the shape of professional development seems to have changed little over the

years (Grant, 1996; PCAST, 1997; though see some noted exceptions such as Krajcik et al., 1994; Richardson, 1994). In-service workshops tend to be professionally led, occur outside of the school workday and the specific teaching environment, and take place during highly bounded perods of time.

## Challenges of Professional Development for Technology

Several challenges have been identified that stand in the way of straightforward proposals to provide teachers more learning opportunities. First, teachers already have limited time in their work day to meet their professional teaching, advising, and service obligations, and the trend is that these challenges are increasing (Olson, James, and Lang, 1999). Yet teachers are regularly expected to take on new learning assignments with no additional compensation or reduction in work load.

Second, avoidance of technology is often attributed to so-called "phobias" (technophobia, computerphobia, and math-phobia) within people. But recent writings have challenged these intrinsic models, and noted that many real problems such as poor design, hardware and software "bugs" exist outside of the operator, and within the technologies and the situations that deploy them (Landauer, 1995; ROSEN, SEARS, & WEIl, 1993; ROSEN, & WEIl, 1995; Scull, 1999; Worthington & Zhao, 1999). Schools, in particular, often lack sufficient technical support for new technologies (Lackie, 1999; Wiebe, 1999), and seldom have the in-house knowledge, skills and experience needed to teach the staff about new technological innovations. In

practice, this means that there is often no pre-established educational technology learning community for teachers to join, and few opportunities to share relevant technology knowledge among peers. Districts may offer regular workshops, but these tend to occur outside of the school workday and outside of the specific teaching and work environment in which the knowledge and technology are to operate (Little, 1993; see also Macmillan, Liu, & Timmons, 1997). Those who wish to learn about educational technology, and apply it to one's own professional and curricular goals, often must "boot strap" their own learning. Furthermore, districts seldom provide for long-term technical support from outside the school. This makes it difficult for schools to keep technology updated, capitalize on the newest innovations, and maintain equipment.

Third, teachers as a group often have diverse goals and levels of acceptance for educational technology (Scull, 1999). Some have extensive skills in one or more areas, and seek to use technology in ways that closely resemble adult uses in industry and science. Some are seeking entry level skills and applications. Still others are critically examining the nature of educational technology, its role in schools and in society as a whole before adopting it for classroom or professional use. Some schools have access to vast amounts of new forms of technology, while some lack have little. It is difficult in a single district-wide workshop to address the broad range of needs and objectives of different schools and individual teachers.

## The Proposed Solution: Working Shops

To address these complex challenges and enable teachers to acquire the vast and dynamic knowledge and skills needed to teach with and about technology (Becker, 1993), a school must be a learning organization —where all staff members are engaged in a continual learning process intended to support each participant' goals. Participants of a successful learning organization must form a collaborative network of learners and practitioners that allows them to pursue individual and institutional goals and projects, contribute diverse collections of knowledge and experience, and share vital information, interests, and activities (Lave & Wenger, 1991; Scardamalia & Bereiter, 1994). However, such organizations do not simply constitute because there is a need. Neither is it the case that simply any form of organization will do. The approach must be specific to educational institutions, and be informed by prior work in the areas of learning and professional development.

Recognition of this need has informed more than a decade of school restructuring efforts (e.g., Sizer, 1992; McLaughlin & Talbert, 1993) and helped to shape much of current learning theory (Bransford, Brown & Cocking, 1999; Greeno, Collins & Resnick, 1996). Ironically, however, it is rarely applied to the learning efforts of teachers themselves (Archer, 1997; ECS, 1998; though see Thomas, Wineburg, Grossman, Myhre, & Woolworth,

1998 for a model that promotes on-goining interactions among English and history high school teachers).

As a means to address some of the challenges facing teachers who seek to learn more about educational technology, we have developed Working Shops (WS) as a structure that helps teachers form certain types of learning organizations. Working Shops helps teachers to obtain support from within the school and from the larger professional and academic community that can aid teachers in meeting their learning needs.

The basic design of the WS process is surprisingly simple. Educators work in multidisciplinary teams in order to create products (e.g., curriculum materials and tools) that address specific professional goals generated by the teachers themselves. Goals may include learning to use technological tools to increase teachers' efficiency, or creating products that will be used during classroom instruction. Executing collaborative, contextual learning is very demanding, and it requires teachers to reconceptualize their teaching practices and collegial relationships (e.g., Brown & Campione, 1994).

WS were created for practicing teachers in response to the isolated workshop and daily work experiences common to the teaching profession. WS are designed to support the staff as a community of life-long learners. Drawing on learning models often found outside of traditional public school education (e.g., artists' studios and scientific laboratories), WS recast teachers' professional development by emphasizing a process of continual,

contextualized doing, producing, and reflecting within a sustainable professional learning community.

In the following sections, we elaborate on the theoretical framework that guided the design and implementation of the Working Shops teacher professional development as it has been applied to technology learning in one suburban high school. We compare the Working Shops approach to traditional in-service workshops, and present the formal Working Shops model (WSM). We then describe how the initial three-year implementation of the program fostered changes in teachers' knowledge and instructional practices and acceptance of technology, while it led to shifts in collegiality within and beyond the school. Finally, we discuss the larger policy issues needed to support and sustain teacher-directed staff development and identify some of the research needs and policy issues facing teachers and teacher educators, educational researchers, and those in positions of educational leadership.

## History of Working Shops

The WS Project brought together three educational institutions in Boulder, Colorado—New Vista High School (NVHS), the Center for LifeLong Learning and Design (L3D) at the University of Colorado Institute of Cognitive Science, and the University of Colorado School of Education (SoE). The initial WS program was initiated at New Vista in April, 1997.

New Vista High school describes itself as a school that seeks to "break the mold" of conventional high school practices. A non-traditional public school of about 300 students and 30 staff members, New Vista uses innovative strategies to prepare students to become individuals who will function at a high level within our complex and demanding society. The staff expects students to integrate what they are learning with what they already know; find connections between classroom learning, themselves as individuals, and the larger world; and to undertake rigorous learning within the context of the established traditions, disciplines, or practices. Far from an "academics only" high school, NVHS emphasizes service learning and a focus on students' articulation of their future paths.

One of the core commitments of the New Vista staff is valuing diversity and preparing students to function well in a multi-cultural society. The school employs heterogeneous and cross-age student groupings, an inclusion model of special education, and a strong multi-cultural curriculum that explicitly recognizes the contributions of diverse peoples to history, literature, and the visual and performing arts.

In a similar fashion, the teachers at NVHS seek to build on their prior knowledge as they face their own learning experiences. It is from within this context that the staff identified a critical need to improve technology knowledge and use both in the classroom and for a variety of professional activities. In 1997, the staff agreed to commit to an entire year of

technology-oriented professional development that would suit their current needs. The school obtained a small grant to pay for substitute teachers throughout the year so teams could meet during the workday.

Teams composed of members from all three participating institutions (NVHS, the Center for Lifelong Learning, and the School of Education) formed during two summer work sessions (each two days in length) conducted in June and August of 1997. The teams then met approximately eight times each during the 1997-98 school year to address specific learning goals and create specified products that would aid them in their practices.

**Initial Steps in Team Formation**

- Goal identification
- Survey of the landscape of educational artifacts
- Critical evaluation (using explicit criteria) of the artifacts
- Sharing findings
- Agreement on a product and work plan

Initially, the teams formed around curricular themes such as science and mathematics, humanities, social studies. But exploration of curricular and professional goals, various technology-based tools, and project ideas, led quickly to a general interest in learning how to use and develop Web-based resources. That interest expressed itself in the form of particular Web

tools that various teams began to construct, including a prototype Virtual Library, a Web Research Tutorial site, and a Transitions Clearinghouse site.

As of this writing, the Working Shops teams have met on a regular (at least monthly) schedule over a 3-year period. Through these collaborations, Working Shops participants have learned new technologies, adopted new instructional practices that incorporate technology, collaborated on the creation of new educational tools and strategies, and enhanced their sense of professionalism and collegiality.

The participatory process created opportunities to include community members who were experts in a range of areas. In particular, educational technology designers and teachers had mutual interest in creating and shaping technology that was useful for education. For example, by including technology designers in the Virtual Library team, that group strengthened their designs and developed a highly useful and useable end product.

**What are Working Shops? Three Vignettes**

The Working Shops model is essentially a kind of social technology. Rather than presenting teachers with a specific instructional approach or form of technology, Working Shops provide the means through which new approaches and educational technologies can be reliably created, understood, and used by teachers in their classrooms, during student advisory sessions, and for preparation activities. Three example WS projects are listed below.

A small high school acquired, as part of its birth, an elementary school building as its permanent home. The school had no library, and will likely never have the space or money to add one. A nearby branch library is inadequate for high school level reference materials and has limited hours. In response to this need, a Working Shops team comprised of teachers in language arts, social science and science, along with a university computer scientist and a member of the local School of Education formed. The team designed, constructed and now uses a Web-based "virtual library" (VL). This hypermedia environment provides students with reference materials, access to periodicals all over the world, book stacks, and reserved readings. It also provides a writing center, VL search support, and access to a world-wide library search program and, the World Wide Web. While language-based URLs may be entered, a spatial depiction of the floor plan of a fictional library is also provided to support browsing (Figure VL).

Team members addressed a pressing school need, and at the same time developed their skills and knowledge of using the Internet, searching the WWW, and constructing web pages for teacher and student use.

A social studies teacher in the school wondered about the uses of computer simulations to help students understand the complex interrelationships that lead to social phenomena such as civil unrest, demonstrations and labor strikes. He initiated a Working Shops team along with two cognitive scientists from the university who were developing a general computer simulation tool. They brought the tool into a class called "Protest and Reform" and invited students to move away from the traditional research report and construct dynamic models of some of the historical and social events that they read about. Two girls modeled the Caesar Chavez Grape Boycott, which showed how the immigration hiring practices in the fields influenced grape prices in the marketplace. This and other student projects led the teacher, initially unclear of the merits of technology for teaching social studies, to believe that "it takes a different level of knowledge to create a simulation that works, than to make a poster or write a research paper. The students needed to dig really deep to build simulations and make clear connections. So those students went deeper than most research projects, and learned a lot more as a result."

Philosophically, the school is committed to the social and emotional, as well as the academic and intellectual development of its students. The schools' World Wide Web Home Page states, "We encourage and support student self -determination and achievement within the school and beyond." However, student advisors faced a challenge. Traditionally, there has been a great deal of information available to students who pursue a small number of traditional paths from high school, such as college and local employment, and little for alternatives. The new technology of the World Wide Web has vast resources, many that fill this void, but the information on the Web is poorly organized. Specific information can be very hard to find. To correct his, the advisory staff formed a Working Shops team and committed themselves to learning how to use the web to find and organize common and alternative post-secondary transition information. They created the "Transitions Clearinghouse" web page, and supplemented traditional post-secondary material with travel information for teens and young adults, references to scholarship opportunities (particularly those with no application fees), and international as well as local community service opportunities. The Transitions web page also provides links to questionnaires on students' interests and career choices, information about drug use, safe sex practices, and other areas of interest and importance to young adults.

**Philosophy of Working Shops**

Central to the Working Shops model are several elements from contemporary learning theory and recent approaches to staff development intended to address the challenges of professional development for teachers in the area of educational technology.

Working Shops have their philosophical roots in current socio-constructivist learning theory and situated cognition (e.g., Greeno, Collins, & Resnick, 1996; Resnick, 1987). Within this theoretical framework, knowledge acquisition is considered to be an active process whereby the learner constructs new knowledge in response to current needs by relating new information and skills to prior knowledge. While knowledge construction may be considered an individual affair, much of the learning occurs through socially mediated interactions (discourse, collaborations) with peers and mentors (e.g., Brown & Campione, 1994; Collins, Brown, & Newman, 1989; Vygotsky, 1975).

The development of professional knowledge in authentic learning situations, such as learning "on the job," can be seen as particularly social in nature. In acquiring knowledge, members of a community of practice model desirable practices for learners who are developing their competencies. Learners are motivated by their personal and professional goals to become acceptable participants in the community and address pressing needs. In so doing, they attune to the regularities of the work environment, while acquiring the linguistic and perceptual patterns that facilitate appropriate practice (e.g., Greeno, 1997; Wenger, 1999). Knowledge in the community is distributed among individuals and groups, as well as among culturally constructed artifacts, tools, idioms, and books. The specific practices that lead to the desired behaviors are learned within an encompassing

environment that constrains the practices while providing the context for learning and performance (Gibson, 1986), and subsequent re-use.

By design, WS staff development activities are school-based and school-wide with "buy in" from the staff established at the outset. Teachers are expected to participate in professional development activities during their workday, and make a long-term commitment to work toward he individual and team goals. This model provides a kind of reciprocity -- "company time for company work," as one teacher puts it -- that is absent from many forms of staff development. WS are integrated into teachers' regular activities, and teachers play a key role in identifying their own professional needs, setting their own goals, and directing their professional development experiences to meet these goals.

Working Shop activities are also product centered and project based. Learning and producing are central to the WS process. In this way, the program capitalizes on recent and older findings that learning-by-doing within goal-oriented contexts facilitates learning and subsequent transfer (CTGV, 1996; Krajcik, 1994; Simon & Kotovsky, 1963). To some extent, the products that are built to enhance teachers' work and the knowledge and skills that are acquired and employed help to determine the success of a WS project. These professional development projects may also encourage teachers to use technology in their future teaching, and to regard technology

as more suitable for constructivist forms of instruction (Marra & Carr-Chellman, 1999).

Because the goals of this program are quite ambitious, the typical training and coaching model of most in-service workshops (Little, 1993) is insufficient. As a result, collaboration and collegiality among the staff and with outside experts is explicitly imbedded in the design (Clark et al., 1996; Krajcik et al., 1994). External specialists in curriculum design, pedagogy, content, and technology serve as partners to support teacher learning and teacher-directed projects.

It is also clear from contemporary theories of learning and teaching that teachers engaged in collaborative projects must have opportunities to reflect regularly on their goals and their professional development progress. For example, Krajcik, Blumenfeld, Marx, and Soloway (1994) show that elementary school teachers implementing project-based science in their classrooms follow a cycle of collaboration, enactment, and reflection. As with WS, teachers collaborate with their peers, as well as university personnel and content and technology experts to plan and enact projects. Teachers reflect on their planning and teaching experiences with peers and develop strategies for addressing challenges and unexpected outcomes.

**Essential Elements of Working Shops**

There are five essential elements to Working Shops: Collaboration, context, time, reflection, and administrative support. Collaboration within

teams constitutes the largest component of Working Shops. Thus, the formation of teams requires careful attention. This process intertwines the identification of individual learning goals, recognition of common interests, consideration of related educational artifacts, and selection of a compelling project. Participants come together because they have a common goal to produce something they need, or to learn a set of skills and concepts. As one participant put it,

> I loved the learning that happened from each other. We would collaborate, build off each other. (J. 3/22/00).

The shared purpose is rooted in the participants' professional goals and provides the "buy-in" for busy practitioners, while situating the learning within their work practices.

Learning during Working Shops is contextually bound. It is done in the process of creating concrete products that the participants value, and so it combines knowledge acquisition and knowledge application. Participants make a substantial regular, ongoing commitment of time (described later) dedicated to shared work and learning.

Participants also use some portion of their time in teams to reflect on their accomplishments and their learning process, raise questions, identify needed resources and direction, and evaluate their current progress with respect to their long-term and near-term goals.

> There were unanticipated positive outcomes: First, we had the ability to be reflective about what we're learning. My three-hour team meetings over the years created a lot of learning that helps all facets of the work.... Working Shops allowed me to take the time to discuss what is it that we're learning. This is often unavailable in traditional workshops. (S, 3/22/00)

Regular structured interviews, staff-wide presentations, and formative evaluations help teams to obtain feedback and make mid-course corrections to this learning process.

Finally, Working Shops needs administrative support to function well. Staff members need the release time organized through the main office to have the flexibility to meet and to pursue learning goals and collaborations. WS participants typically need space to meet, and may call for additional training and capital equipment resources. Institutional leaders must serve teachers as allies in teachers' learning process.

**Comparing Working Shops and traditional in-service workshops**

In the context of professional development for educators, the term "workshop" applies to many different learning activities -- from a one-hour speech to a week-long session of intensive, collaborative practice in one area of study. In-services needn't even be primarily about teacher learning, but can focus on disseminating new policies or school reorganizations (Peterson et al., 1996). However, the primary modality for staff development continues to be the workshop that lasts for a few hours and employs a

training-and-coaching model (Little, 1993; PCAST, 1997). Teachers are, for the most part, still expected to learn new tools and methods that are selected by someone else, and engage in learning on their own time, away from the work context in which the new knowledge needs to be applied.

These unembedded learning experiences rarely have lasting impact on teachers' professional knowledge, and seldom transform the school as a learning organization. Professionally led workshops also tend to lead to an over-reliance on outside experts and pre-packaged curricula that contribute to the "deskilling" and boredom of teachers (Apple & Jungck, 1990 AERJ). This continued dominance of the traditional workshop approach to professional development stands in ironic contrast to the clear consensus of research regarding professional development, as well as contemporary theories of student learning (Bransford, Brown, & Cocking, 1999 HPL; Grant, 1996; Greeno, Collins, & Resnick, 1996; Kleiman & Johnson, 1998).

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PLACE TABLE 1 ABOUT HERE

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Table 1 presents a high-level comparison between workshops and Working Shops that helps to illustrate some of the major differences. One critical distinction between traditional workshops and Working Shops is exclusivity. Based on a national survey of professional development related to technology, most workshops are conducted for a day or less (PCAST, 1997). Regardless of length and design, a workshop occurs exclusively at

one period in time and does not reconstitute itself. Because of this feature, workshops are best used to support individual "moments" of learning — introducing an idea or technique, concentrating on a particular activity, creating a forum for meeting colleagues.

Working Shops, on the other hand, emphasize continuity and context. As the vignettes show, they are created to address current needs that impact the knowledge and skills of teachers and the ways that they conduct their future teaching. Working Shops teams form with a long-term commitment (at least a school year) to address a need, and the members negotiate the team's agenda so all concerned feel that they are benefiting individually as well as institutionally.

The second significant difference is that traditional workshops are typically designed and run by personnel outside of the participant group to meet a need that comes from "above" (Krajcik et al., 1994). This undermines teachers' ownership of their own professional development, and tends to ignore teachers' insights about how changes in their own schools and in their own teaching practices should be carried out. In the standard workshop, people are generally unable to see the relevance of what they are being taught because the material presented is disembodied from their everyday experience. The material to be learned is formulated by people external to the community, and problems usually have an artificially "closed," well-defined nature (i.e., the view that there is one correct answer

and one prescribed process for obtaining that answer). In contrast, Working Shops meetings are organized by participants to meet a stated need that emerges from within the participant group. Outside resources, such as experts in educational technologies, curriculum development and pedagogy, are brought in to serve the team members' needs and goals.

Acknowledging that these perspectives in staff development are important for teachers does not in and of itself suggest a model that will support and encourage their implementation. In the next section, we present Working Shops as a prescriptive model of professional development and show how it has been influenced by the work of others. We then share results of its implementation over a 3-year period.

## The Working Shops Model for Professional Development

The task of teacher professional development can be viewed as a process that advances teachers from their current state of knowledge and practice toward their professional goals (cf. Glaser, 1976). To advance, it is essential that teachers articulate their goals clearly, and that their current levels of skill and knowledge are adequately assessed. The Working Shops model for professional development (see Figure 1) prescribes how to document the current knowledge states and goal states of participating teachers. It shows ways to support development of the appropriate knowledge and products that can help reduce the gap between these two states.

PLACE FIGURE 1 ABOUT HERE

**Eliciting teachers' professional goals**

At the beginning of the Working Shops program, it is crucial to establish a safe and collegial climate (Richardson, 1994; Eliz. Cohen 1986) in order to ask about the personal and professional goals of each of the participating teachers.

Once this climate is established, teachers' goals are elicited through semi-structured peer interviews and written surveys. As our model indicates, teachers' goals provide a vital aspect of professional development process, because they delineate the target set of knowledge, skills, and artifacts for teachers' future instructional practices.

The goal-elicitation process helps in the early formation of a community of practice because it highlights the common purposes participants bring to the project: the further development of their teaching. To facilitate this, summaries of these goals are shared in small groups and publicly recorded (e.g., on poster board). Goals can include building certain products, developing specific skills, and acquiring certain concepts. Goal elicitation also aides teachers by uncovering tacit reasons behind their instructional practices (Fenstermacher, 1994; Nathan 1997 Practical Argument).

In our experiences, many teachers had not thought about what they wanted to learn about, or what they wanted to achieve in their current classes since they were students in their teacher education programs. Thus, teachers found this to be a difficult, though ultimately an attainable task. The goals voiced by teachers are presented in the Results section.

**Assessing the current state of teachers' knowledge**

Knowing "where you are," like knowing your destination, is critical to planning for and guiding change. To determine the current state of a teacher's technology facility, the Working Shops Model (Figure 1) calls for documenting the forms of technology currently and previously used by teachers in their instruction, in and outside of schools. The model also calls for an assessment of teachers' skill and comfort levels, and an evaluation of the current state of the participants' knowledge. In accordance with constructivist principles of learning (e.g., Greeno, Collins, & Resnick, 1996; Smith, diSessa, & Roschelle, 19XX JLS), Working Shops are designed to provide continuity with teachers' prior knowledge. The model of Figure 1 can be reconstituted over and over again to move teachers along advances states of knowledge toward more demanding goals, as depicted in Figure 2. Working Shops projects meet participants where they are, and then build upon their pre-existing foundations to extend teachers' current knowledge, skill levels, and conceptions of what their classrooms can look like.

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**Closing the gap through the professional development process**

In order for participants to advance toward their goals, they must acquire new competencies. The Working Shops Model acknowledges the socio-cultural nature of the educational artifacts (e.g., curricula, technologies) identified by teachers in their goals, as well as the power of participating in a community of learners (e.g., Brown & Campione, 1994). Working Shops participants are thus organized in teams that share common professional goals, and include members expert in relevant areas (e.g., technology, mathematics learning, pedagogy) who are enlisted specifically because they have agreed to serve the teacher-participants in meeting their stated goals.

The importance of working toward some specified goal

Product-based learning, as a shared purpose and context, is an essential aspect of the Working Shops process. It contributes to the success of the Working Shops approach for three key reasons. First, product-oriented activities are at the appropriate grain size for most educational practitioners (Eisenhart et al., 1988). Second, the work has direct relevance to the participants' professional lives. Third, the work responds to urgent societal expectations that educators need to be skilled users and critical evaluators of current pedagogical practices and curricular development.

## Results and Conclusions

The WS program produced marked changes in a variety of areas. We discuss these areas, and present three forms of data: self-report data, which documents teachers' perceptions of their initial and final skill and comfort level with technology; the products made by WS teams; and an evaluation of the WS program as a model for professional development, as revealed in an interview with 6 of the teachers. First, however, we discuss the history of the WS project and the school setting.

### Baseline Data

Twenty-five of the 28 staff members of NVHS completed the baseline survey in August, 1997. The amount of teaching experience ranged from 0 (new teachers) to 35 years, with a mean of 9.5 years.

Background with Technology

Staff members were asked to rate their skill level on 13 common areas of technology, on a 5-point scale, where 5 indicated "Very Proficient" and 1 indicated "No Experience." Table 2 shows the means of the self-reported staff skill level from the baseline survey.

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As is evident in the data of Table 2, the staff as a whole reported the highest proficiency in word processing, email, and web browsing. There was

also a moderate skill level reported for general use of computer technologies, in general (slightly above 3 out of a 5-point scale). The staff members did not consider themselves as very proficient in more advanced uses of computers and other new technologies, such as desktop publishing and graphics, databases, web page authoring, programming, and general Internet use.

In reviewing the data, we found it useful to distinguish between high-skill and low-skill staff members, based on their general computer usage and web page authoring experiences. These are shown in the columns of Table 2. Technologically high-skill staff members reported being significantly more proficient than their colleagues in several areas: word processing, desktop publishing, graphics, spreadsheets, databases, email, web browsing and web page authoring, Internet use, general computer operation and problem solving, and the school network. As expected, high-skill staff members reported a greater comfort level (average 4.25 out of 5) than low-skill users (3.1 out of 5).

Of particular importance are areas where no differences were found. For example, programming was generally low for both groups, with no difference evident. Surprisingly, staff members in both skill levels reported similar amounts of weekly computer usage. And, most strikingly, both skill levels reported attending similar numbers of district-sponsored technology workshops. What is important to note here is that the numbers for both

groups are exceedingly low, less than one course per teacher. This suggests that technology training up to this point in these teachers' careers has not been a high priority for their teaching district. It also suggests that high-skill technology users did not become highly skilled through district courses, but rather tended to learn the technology on their own. This underscores the need of new approaches to professional development for teachers seeking to learn to use technology more in their teaching and other professional activities.

Initial uses of Technology

Staff members were asked to identify the kinds of computer applications and technology used most commonly during a normal work week. Word processing was reported by 100% of the staff, followed email (85%) and browsing or gathering information on the World Wide Web (68%). Staff members were also asked to describe the purposes that technology served. In addressing this question, respondents were told to include time spent at home and at school, but only count time in which you use the technology for school purposes. The most frequent purpose reported was for writing (92%), while the second most frequent purpose was for gathering information and ideas for classroom use (56%).

Initial Goals

When asked about their personal goals for professional development during the working shops, most respondents indicated an interest in

becoming more adept at using computers and technology in general, and developing lessons that incorporate the use of technology.

Nearly every participant (88%) believed technology could be used effectively in his or her classroom. But many expressed concerns about its availability and access. Several teachers also felt the role of technology in classes must be clear, so it is not used just for the sake of "being high-tech." For example, one social studies teacher questioned the effectiveness of technology as an "instructional" tool, saying he could require students to use it, but found it "problematic" as an instructional support.

Conducting research and presenting information were cited most often by teachers as the best uses of technology. Several others mentioned the motivational aspect of using technology for students as its chief benefit.

The ideas listed for how teachers may use technology in the classroom included: using the Internet for research; using e-mail to communicate with other students and information sources; connecting via satellite with Spanish-speaking classrooms to enhance language acquisition; faster and more efficient communication; writing and word processing; using a WWW home page for assignments; asynchronous discussions about books; access to electronic texts; computer simulations and demonstrations; using CAD for blueprints and architectural/engineering plans; statistics and other forms of data analysis; and workforce preparation.

The staff was also asked to consider what they might need to bring technology into their classrooms. Peer-level support and idea-sharing were cited most often (84%), followed by "lots of hands-on, technical support" (44%), and "minimal hands-on technical support" (28%). Other anticipated support needs that were reported included having time to learn, practice, and incorporate new technology into classroom, and the need for ongoing instruction or education on the uses of technology.

Working Shops Projects

Table 3 shows a brief listing of the major projects that were pursued within the professional development program, along with the years each was pursued. While the range of content area of the projects is broad, it is apparent that early on teachers tended toward web-based forms of technology, as with VL, Transitions, Web Research, Spanish Web, and Outdoor Leadership. In later years, the staff extended the applicability to non-technology oriented projects (such as Inter/Intra-personal Skills, Integrated math, and Writing Rubrics), and showed the generalizability of the WS model. This is discussed further in the Discussion section.

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PLACE Table 3 ABOUT HERE

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## Final Evaluation

In March, 2000, approximately 3 years after the initial meeting, the NVHS staff completed a round of questionnaires, and several members participated in a group interview, all aimed at documenting the changes that occurred in the school during the WS implementation.

### Changes in Technology Knowledge and Skills

The final evaluation questionnaire contained many of the same questions that were part of the Baseline questionnaire in order to support comparisons. Some attrition of the school occurred, leaving only 17 respondants (out of 20 current participants), two of whom were new to the school during the program.

It is immediately clear from examining the final evaluation data (Table 4) that the very large differences in perceived skill between the High-skills and Low-skills groups have all but disappeared. The baseline data revealed significant differences in 12 out of 13 areas of technology. The final evaluation data show only two such areas – Web browsing and Web authoring – and these differences are not nearly as large as the earlier data.

Teachers' reported comfort with technology still favors the high-skills group; again, to a lesser extent than reported at the beginning of the program. One new questionnairre item also showed a significant difference between technology skill levels. Teachers were asked to rank, on a 5-point scale, the degree to which the WS program fostered greater peer discussions

around issues of teaching and learning. Overall, 71% of teacher-participants reported that the WS program helped them either somewhat or a great deal. To improve peer discussion The split by skill level also showed that those who reported being technologically low skill at baseline, rated the impact of WS on their interactions about teaching and learning significantly higher than the high-skill group.

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PLACE Table 4 ABOUT HERE

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Overall, the members of the NVHS staff reported increases in their skill levels across the 12 technology areas common to both questionnaires. Major increases were reported in database use, email (particularly due to learning how to send and receive attachments), use of the WWW for browsing, information gathering, and Web page authoring, general Internet use, and use of the local school network for printing, exchanging files, and accessing files and applications remotely. A few areas showed small decreases. At final evaluation, the participants reported less competence with word processing, graphics, and general computer operations and trouble shooting. This apparent decrease in skill level is likely to be due to a greater awareness of the deeper complexity of some relatively familiar applications. This was particularly true of the high-skill group, who initially reported higher facility with web authoring and general computing. They reported less facility with 7

of the 12 areas. A particularly strong drop occurred in computer programming, an area not emphasized in any of the working shops. This drop alone, was due to the departure of two math/science instructors who reported high levels of competency at baseline. Yet it is evident that as teachers learned more about some of the capabilities of technologies like their word processing programs (which are really more like suites, integrating data analysis and color drawing for example), graphics software, databases, and computer architectures and trouble shooting, they became more aware of the narrowness of their baseline knowledge. As one teacher (SL) put it, "I feel more inadequate." Even with these drops in teachers' sense of their skill, teachers reported greater comfort with technology, and moderate to large increases in 6 out of 12 areas of technology.

The participants who originally considered themselves relatively low-skill in technology, reported moderate to large increases in all but 3 areas. Word processing changed little, though there was a slight trend toward perceived improvement; graphics ratings dropped slightly; and programming showed small, insignificant gains.

Changes in Uses of Technology

The major forms of technology reported by the staff were the same as those reported on the baseline questionnaire. Word processing (100%), email (100%), and web-based information gathering (82%) were by far the most common uses of technology. The stated purposes for using technology

remained stable over the three years as well. The most frequent purpose for using technology was reported to be writing (88%), while the second most frequent purpose for using technology was for gathering information and ideas for classroom use (59%).

Among new uses of technology, nearly half the respondents reported web-related activities, including using the Virtual Library in their classes, use of the Transitions web site for post-secondary education planning with students and parents, and using the web to gather information for classes. Powerpoint presentations for student and teacher presentations was the second most common new technology to adopt, while use of email for service duties and to contact students was third.

Changes in teachers' perceptions of the role of technology in education

The staff reported many new perceptions of technology and its benefits for their instruction and service activities. Most of the written comments made by teachers fall into a small number of categories (Table 5). Teachers in both skill levels reported a greater sense of personal agency with technology. They felt more comfortable with it, and more courageous about novel technology-based activities. This seemed to be based on the teachers' successful experiences building new technological products, and overcoming the obstacles of learning and implementation. Teachers also reported direct benefits of the technological products themselves. The

Transitions website helped teachers to provide good counseling to students and parents by organizing the relevant information well.

Barriers to technology learning that were overcome

Teachers reported on the barriers to technology use and learning that they personally had to overcome. The major barriers were fear of technology (53%), and lack of knowledge that would interfere with self-guided learning (65%). Poor technical support was reported as overcome by 41% of the respondents. Finally, the need for time learn and to practice was reported by 17% of the staff members.

Thee results parallel revisionist views of technophobia that show many of participants' fears are due to factors that are not simply irrational fears, but exist outside of the operator and are truly outside of operator control (e.g., hardware reliability and poor technical support) (Rosen & Weil, 1995).

Improved Collegiality

The project-based team process also changed how the staff interacted with each other, and learned about each other. Some relished the support structure that permitted them to learn more and do more with colleages than on one's own. As one teacher stated, "I now have time to team up professionally to accomplish goals." Others felt a richer understanding of their colleagues. "Professional learning has expanded in the sense that I understand the diverse perspectives that my colleagues have." In a separate Lickert scale item, all of the Low- and High-skill staff members reported that

the level of collegial interactions improves greatly or somewhat due to the WS program. These results are similar to other long-term professional development efforts that involve regular meetings of teachers to discuss substantive topics (Thomas, Wineburg, Grossman, Myhre, & Woolworth, 1998); Wineburg & Grossman, 1998).

**New Views of Professional Development**

Finally, the teachers shared their views of WS as a vehicle for their own improved learning as professional educators. The tone of these responses was extremely positive. As one teacher put it, "WS has been amazingly useful to me. I'd rank them among the best, most immediately transferable in-service learning [programs] I have had as a professional" (Table 6). The major factors reported by teachers appeared to be (a) the time allotted during the work day to work on valued projects and conduct one's technology learning, (b) the team support and increased opportunities to collaborate with colleagues, and (c) reflecting on one's accomplishments.

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PLACE TABLE 6 ABOUT HERE

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Additional comments made by NVHS staff members shed further light on the impact of the program:

- "I have more confidence using technology now, and a sense of ownership and proficiency I didn't have before."

- "The Working Shops gave me a chance to do something better than I would've done on my own. It was good to have time to plan."
- "It kept me in teaching. I probably wouldn't be here without the connection of my team and the work we did together. It gave me a professional boost!"
- "It was incredibly helpful to work with people who wanted the same outcome. Our product is useful and encompassing!"

## Discussion

The evaluation data show that this program for professional development has great promise. Technology knowledge and use improved across the staff, as did collegiality and teachers' sense of agency. We step back to look at the potential for Working Shops as a model for self-directed staff development beyond this single implementation. We address the extension of the WS model to areas other than technology, look at its potential for use in other schools, and speculate on its scalability to the district level.

### Working Shops Extends Beyond Technology

Working Shops started out as a model for staff development for educational technology. The team approach and emphasis on product development suits technology well. But at its core, there is little that binds the WS approach exclusively to technology. This is evident as we consider

four of the later projects that came of out Working Shops in 1998 and 1999 (see Table 3).

Mathematics teachers, for example, branched out beyond the technology tools for math instruction, and began evaluating a reform-based program for math education. The team focused on Integrated Mathematics Project (IMP) as a way to reconceptualize mathematics courses throughout the secondary program.

The school, and the state as a whole, received a new set of standards for secondary science education from the state board that called for Earth Science education. Since Earth Science is historically not taught in high schools, high schools throughout the state began scrambling to create new courses and sifting through curricular material at the middle school and college levels. A science teacher formed an Earth Science team, and adopted a systems science approach to the curriculum. Interacting with content experts at the University, she formulated a new curriculum that was implemented the following school year.

Staff members felt a need to integrate writing throughout the high school curriculum, and considered a common rubric for evaluating student work. However, the rubric was not fully articulated, which made it more burdensome for teachers outside of language arts. A new team, The Writers' Bloc, formed to specify the rubric more fully, provide student examples, and

hold staff workshops to provide the staff with opportunities to understand the rubric and practice applying it to student writing samples.

Teachers also have recently formed an inter-/intra-personal skills team that address The team is currently developing a core curriculum that will carry through the 4-year high school experience, and is considering course topics such as peer mediation, conflict resolution, experiential and outdoor education.

Each of these examples of new teams demonstrates how the WS process allowed teachers to pursue perceived needs and work within the collaborative structure to produce products valuable to their school.

**Replicability and Scalability of the Working Shops Model**

The combined elements of Working Shops create a deeper and more sustainable program of teacher professional development than is typically implemented. WS supports concrete application of what one learns in daily practice. The experience at New Vista suggests that the impact of Working Shops on individual teachers and the school community will influence the school long after grant funding has disappeared. It also shows that the support base is broad. Teachers support institutionalization of the process because they experience immediate, concrete results, and because they see their roles as learners and professionals valued and strengthened. Teachers appreciate the opportunity to select the points of entry (goals, tools, and strategies for learning); and the teachers' efforts are bolstered by the public

exhibition of products and by the mutual responsibility of team membership. Educational administrators support institutionalization because they will see the pay-off through enhanced classroom performance and stronger learning communities.

These benefits are obtained through a minimal investment of resources. Working Shops entail an initial investment of resources, primarily extra money to pay for substitute teachers. However, these investments are almost immediately and quite clearly rewarded through the creation of useful new tools, improvements in teachers' use and knowledge of technology, as well as a more collegial school community. Recognition of these factors prompted the New Vista faculty to decide unanimously, just a little more than halfway through the first year of the project, to make Working Shops a permanent feature of the school.

Although the current implementation of Working Shops used outside funding obtained from a private community-oriented foundation to pay for release time for team meetings during the school day (primarily in the form of costs for hiring substitute teachers), this should not be seen as a fundamental barrier to the WS approach. There are many local and national funds to improve education, including private foundations, businesses, and local and federal government agencies. Furthermore, school districts pay large sums of money to organize teacher in-services, and hire outside experts to conduct these trainings. It is reasonable to propose that a district

consider redirecting portions of that money to fund continual staff development in the form of Working Shops. These avenues should be explored by schools seeking to adopt this model.

While to date the Working Shops have involved a major research university, such collaboration is not necessary for replication of the Working Shops model. Community colleges, consulting organizations, education agencies (i.e., regional laboratories), community organizations and for-profit businesses may be suitable collaborators, depending on the school's collective goals and the available pool of potential partners. In areas where a university-school system collaboration is feasible, the Working Shops model offers opportunities for conducting field-based research, infusing research-based curriculum and instruction techniques into current practice and, ultimately, shaping teacher preparation programs that are consistent with and complementary to current teaching conditions and contemporary curriculum standards.

The elements that combine to make Working Shops successful at an individual school also provide the foundation on which to extend the process to other schools and institutions.

## Layering of Communities: The Potential to Extend Working Shops to the District Level

We have shown how teams of teachers form around concrete learning goals pursued through the creation of specific products at a single school.

The individual school itself acts like a team, developing a general focus, distributing mutual support among the teams and individuals, and sharing the results. Among a group of schools, one can imagine how each would have its own focus based on the particular interests of its faculty. The collective schools act as a team as well (coordinated by a planning group whose members come from each school), developing a broader focus, providing mutual support, and sharing results. Within the individual school a planning team coordinates the Working Shops, and this process is replicated among several schools. The planning team members at every level are also active members of individual working teams. Through this fractal organization, a growing Working Shops program retains the characteristics that generate personal, professional value for each participant of each team.

**Local context**

Situating the combined work and learning within each school or partnership in which teams are created ensures that the professional development always occurs in a context that is meaningful to all of the educators involved, regardless of how numerous or how widely dispersed they are. The locus of decision-making is always the particular school or local partnership; in fact, the teams themselves need to be the primary decision-makers. The local context of the school also makes it easier to identify the constraints, resources, and skills teachers have to work with, which in turn makes it easier to adapt those environmental factors.

**Dynamic balance of framework and flexibility**

Following the prescriptive model, the Working Shops process builds on a stable framework that provides clear direction for planning and implementation — goal-setting, team formation, product-based learning, and continuity of work. Within that general structure individual teams and faculties have a high degree of flexibility. They identify their own focus and goals, create products that are directly useful in their environments, set team schedules, and direct the resources. The local flexibility prevents the larger process from becoming rigid and irrelevant, while the strong guiding framework prevents the local process from drifting and disintegrating.

**Rethinking Professional Development**

School reforms do not flounder for want of good ideas; they fail because the good ideas are not well implemented (Thompson, 1992) or cannot be implemented on a large scale (PCAST, 1997; ECS, 1998; Fullan & Miles, 1992). Whatever the specifics, the value of educational reform will not be realized without the insights and full participation of the professionals in the field. It is they who are almost entirely responsible for the process of cultivating learning.

However, to participate meaningfully in the process of reform, teachers need to change how they operate professionally. In a reform climate, educational practitioners must be willing to experiment with different teaching methods, and evaluate their actions and that of their

students (Glaser, 1976). They need to master the innovations, apply and assess the effectiveness of these innovations in various learning situations, and, in light of these experiences, rethink how to approach teaching and learning. But teachers need not do this purely on their own. There are vast resources within schools and in the greater communities, if only teachers felt that they had the time and organizational structure to take this on, and that they efforts are directed toward relevant goals.

The challenge confronting research on educational policy and practice, lies in finding a method for ensuring that innovative design and implementations of curricula have widespread, lasting impact (Rényl, 1996). Obtaining such impact requires strategies that enable the non-pioneering majority of teachers and schools to use the innovations effectively and enthusiastically. A promising, replicable process for instituting reform like the Working Shops program is essential for transforming creative innovation into meaningful change.

This challenge is especially urgent in the area of educational technology. Despite the increased availability and interest in educational technologies, the manner by which schools incorporate technology into classroom environments and teaching practices remains unsettled. In addition, teachers need opportunities to master the new tools, and explore ways in which technology can be effectively used for teaching and learning. Other issues in education—such as curricular and professional standards,

authentic assessment, and integrated curricula—also require a professional approach that involves continual learning by teachers and sustained support for their classroom practice.

While the tools themselves are valuable, the truly important products of the New Vista Working Shops have been the enhancement of teachers' knowledge, skill, and confidence in using technology, and a growing sense of collective professional achievement and shared learning. Recognition of these results prompted New Vista staff to decide unanimously to continue Working Shops throughout 1998-99 and again during 1999-2000. Gradually over the years, the process has shifted the learning from an exclusive focus on technology to a broader range of curricular innovations in mathematics and science, and the structured norms of the school culture. In so doing, it has continued to deliver its intended aims: foster collaborations that support teacher learning, address the ever-changing individual and institutional needs of the school, and provide an atmosphere that engenders collegiality, and uses it as a foundation for staff development that is relevant and rewarding.

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## Tables and Figures

Table 1. A comparison of traditional teacher in-service workshops and Working Shops

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Figure 1. A depiction of the k Shops model of professional development.

Figure 2. The professional development process in operation provides the means for a teacher to move along a sequence of knowledge states toward ever-demanding goals.

Table 1: A comparison of traditional teacher in-service workshops and Working Shops

| | Traditional Workshops | Working Shops |
|---|---|---|
| **Source of topics** | Externally provided from administrators | Constructed by teaching staff to address individual and institutional needs and goals |
| **Emphasis** | Providing opportunities to learn and practice "basic" skills; disseminate information such as new curricular standards | Learning embedded in ongoing work activities that have clear products that are valuable to participants |
| **Structure of meetings** | Didactic, and follows "logical" structure | Activity based with much trial and error |
| **Learner roles** | Expert-novice model | Reciprocal learning |
| **Leaders** | expound subject matter | Engage in work teams as participants |
| **Learning mode** | Knowledge transmission and absorption (Instructionism) | Knowledge construction, learning-on-demand (Constructivism) |

Table 2. Mean baseline level of reported skill for a variety of technology areas for all teachers (n = 25)

| **Area** | All (N = 25) | High-Skill (N = 8) | Low-Skill (N = 17) | Significance level |
|---|---|---|---|---|
| Years teaching | 9.52 | 8.63 | 9.94 | n. s. |
| Total number of district-sponsored technology courses | 0.52 | 0.63 | 0.47 | n. s. |
| Computer time (hours per week) | 4.00 | 5.25 | 3.41 | n. s. |
| | | | | |
| Word processing | 4.00 | 4.63 | 3.71 | .0005 |
| Desktop publishing | 1.68 | 2.50 | 1.29 | .004 |
| Graphics | 1.84 | 2.25 | 1.65 | .000001 |
| Spreadsheet & Accounting | 2.10 | 3.00 | 1.65 | .000001 |
| Databases | 1.92 | 2.63 | 1.59 | .0014 |
| Email | 3.28 | 4.00 | 2.94 | .002 |
| Web Browse | 3.28 | 3.88 | 3.00 | .003 |
| Web page authoring | 1.16 | 1.5 | 1.00 | .0003 |
| Internet | 1.76 | 2.25 | 1.53 | .027 |
| General Computer operations and problem solving | 2.88 | 4.00 | 2.35 | .00000005 |
| School network | 2.88 | 3.63 | 2.53 | .01 |
| Programming | 1.40 | 1.75 | 1.24 | n. s. |
| Comfort Level | 3.46 | 4.25 | 3.10 | .0003 |

Note: High- and Low-skill levels divided by participants' self-reported skills in General computer operations and problem solving, and Web page authoring.

Table 3. Brief descriptions of the Working Shops projects from 1997 through 2000.

| Year of Project | Project Title | Description | Team member affiliations |
|---|---|---|---|
| 1997-2000 | Transitions | Develop and use the Transitions Support Clearinghouse to aid students in their post-graduation plans (e.g., work, college) <http://bvsd.k12.co.us/~blackl/nvhstransition.html> | New Vista: Counseling, Special Education, Applied Technology; School District Internet Director |
| 1997-2000 | Virtual Library | Design and stocking of the Virtual Library for school-based research <http://robin-nvh.bvsd.k12.co.us/virtlib/newindex.html> | New Vista: Social Studies, Language Arts<br>School of Ed: Ed psych, teacher education, literacy;<br>$L^3D$: DynaSites system designer |
| 1997-2000 | Web Research | Create a Web Research Tutorial for research that uses Internet-based methods (e.g., search engines) and critically evaluates the reliability of Internet-based sources <http://bvsd.k12.co.us/~blackl/school/nvhsresearch/Web_Research.html> | New Vista: Language Arts, Special Education.<br>School of Ed: Language Arts<br>School District: Internet Director |
| 1998-2000 | Social Studies Simulations | Design computer-based simulations of processes in protest and reform | New Vista: Social Studies<br>$L^3D$: AgentSheets system designers |

| Year of Project | Project Title | Description | Team member affiliations |
|---|---|---|---|
| 1998-1999 | Outdoor Leadership | A cross-country Bike Trek that used telecommunication and computer technologies for research, journalizing, navigation, and correspondence. <http://www.cranking-it.org> | New Vista: Outdoor Leadership<br>School of Ed: Ed psych, Ed tech;<br>$L^3D$: Associate Director |
| 1997-1998 | Spanish Web | Using Internet and Web connections to create language and culture acquisition projects | New Vista: Spanish Language |
| 1997-1998 | Math/Science Tool Exploration | Exploring the uses of various technologies supporting mathematics and science curricula (e.g., probe kits, graphing and analysis software) | New Vista: Math, Science<br>School of Ed: Cognitive Science |
| 1998-2000 | Writing Rubrics Across the Curriculum | Creating a set of rubrics to guide assessment and teaching of writing across disciplines and content | New Vista: Language Arts, Social Studies, Special Ed<br>School of Ed: Language Arts |
| 1998-2000 | Earth Science Simulations | Design and use of simulations to study basic dynamics of physical global phenomena | New Vista: Biology, Earth Science<br>School of Ed: Ed Psych; Science |
| 1998-2000 | Integrated Math | Applying Integrated Math Project practices and curricula throughout the math and science courses at New Vista | New Vista: Math, Science |
| 1999-2000 | Inter- and Intra-personal Skills | How students interact with one another and monitor their own internal feelings and thoughts. | New Vista staff |

Table 4. Mean level of reported skill for a variety of technology areas for all teachers in the final evaluation survey (March, 2000).

| Area | All (N = 17) | Hi-Skill (N = 5) | Low-Skill (N = 12) | Significance level |
|---|---|---|---|---|
| Computer time (hours per week) | 5.1 | 4.75 | 5.08 | n. s. |
| Comfort Level | 3.6 | 4.50 | 3.62 | .03 |
| | | | | |
| Word processing | 3.8 | 4.50 | 3.83 | n. s. |
| Desktop publishing | 1.5 | 2.25 | 1.54 | n. s. |
| Graphics | 1.5 | 1.67 | 1.54 | n. s. |
| Spreadsheet & Accounting | 2.2 | 2.75 | 2.15 | n. s. |
| Databases | 2.3 | 2.00 | 2.31 | n. s. |
| Email | 3.7 | 4.25 | 3.60 | n. s. |
| Web Browse | 3.5 | 4.75 | 3.54 | .04 |
| Web page authoring | 1.4 | 2.75 | 1.42 | .01 |
| Internet | 2.2 | 2.75 | 2.23 | n. s. |
| General Computer operations and problem solving | 2.7 | 3.00 | 2.69 | n. s. |
| School network | 3.2 | 4.00 | 3.23 | n. s. |
| Programming | 1.4 | 1.00 | 1.38 | n. s. |

Note: High- and Low-skill levels divided by participants' self-reported skills in General computer operations and problem solving, and Web page authoring in the 1997 Baseline questionnaire.

Table 5. Teachers' perceptions of their own technology capabilities from the final evaluation.

| **Baseline** | Code | Written comments |
|---|---|---|
| Low-skill | Increased agency | I believe I can be competent in use of tech. |
| | Benefits own work or work with others | I believe it has a real benefit to my work with students and staff and parents (Transitions Website). |
| | Agency | I trust my ability to trouble-shoot a bit and learn new skills as the need arises or when I choose to do so. |
| | Collegiality | More open to participate and be engaged |
| | Benefits own work or work with others | Learning the basics helped me ratchet up my level of work |
| | Benefits own work or work with others; Collegiality | Great to learn together with colleagues and focus on the learning process, and learn the skills and technologies that are now central to my teaching while on "company time". |
| | Increased agency; Collegiality | WS has improved my comfort with technology and the general atmosphere of collegial learning. |
| | Improved knowledge | No change, just more training |
| | Agency | Less intimidated |
| | Benefits own work or work with others; Collegiality | I now have time to team up professionally to accomplish goals. |
| | Collegiality | Professional learning has expanded in the sense that I understand the diverse perspectives that my colleagues have. |
| | Agency | It is possible [to learn to use technology] |
| | Agency | Feel more inadequate |
| | Agency | I found some new passions |
| High-skill | New potential; Benefits own work or work with others | I have glimpsed the potential of the web, and seen that technology and education can work together (VL), and I need to keep up with changes |
| | Agency | Increased comfort and confidence to try new things |
| | agency | I am more willing to learn |

Table 6. Comments from the final survey evaluating the professional development program as a whole

| Code | Written comments from Final Evaluation |
|---|---|
| Reflecting on accomplishments | I now use the web almost daily and it's a great tool! I am very pleased with my greater comfort with technology. WS made it easier for me to learn these tools. WS has been amazingly useful to me. I'd rank them among the best, most immediately transferable in-service learning [programs] I have had as a professional. |
| Group interaction | Great opportunity to exchange expertise and collaborate! Simply nice getting to know [my colleagues] and [see] how they think! NVHS has made great progress in its evolution thanks to WS. I think it has taken half the time it would have taken if it weren't for this great program. |
| Making time for important things | I am now more thoughtful and intentional about how I use tech to access info; more talk about school issues and teaching philosophy in a relaxed atmosphere; |
| Reflecting on accomplishments; Group interactions | Learn new things across disciplinary lines, ends isolation of working alone all the time and collaboration leads to better projects, more ideas, better lessons. |
| Making time for important things | The model of release time during the school day is critical to the collegiality and success of the staff development. |
| Making time for important things | I like to see learning as part of my work and not another class I [have to] go to after the work day. |
| Reflecting on accomplishments | I've learned to get through the web with greater proficiency; I'm thinking about creating web pages as class activities; overall knowledge of technology has increased; its been great to "vent" with other teachers. |
| Making time for important things | Time to do substantial work that benefits classes and students. Time to evolve our thinking, school philosophy, to practice skills, and build staff relations. |
| Group interaction | It's a great format for staff learning. Love the group problem solving. |

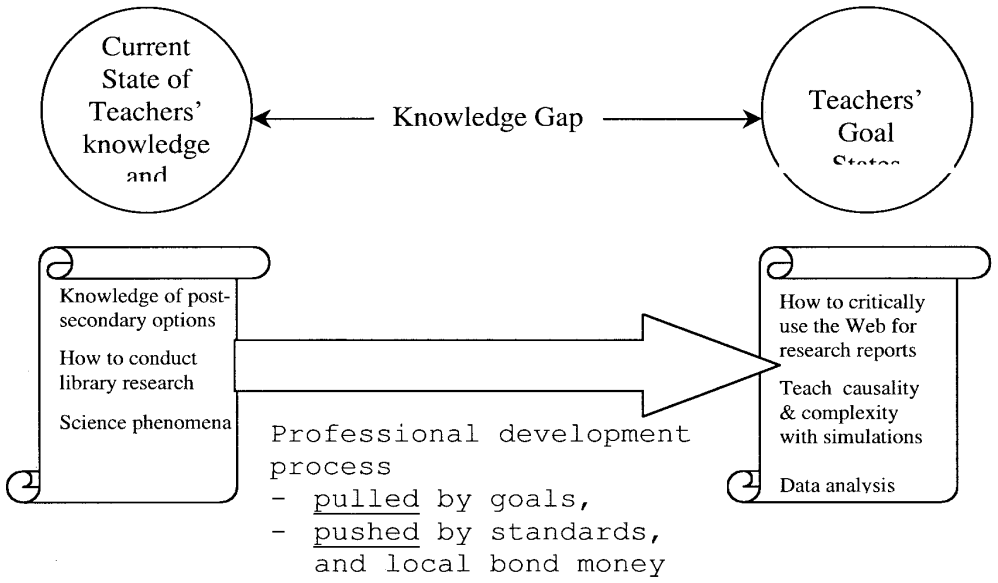


Figure 1. The professional development process is depicted as a means by which teachers' current knowledge states (left) and goal states (right) are assessed, and the knowledge gaps between them are reduced. The process itself is influenced by the goals reported by teachers, and by the need to address curricular and professional standards.

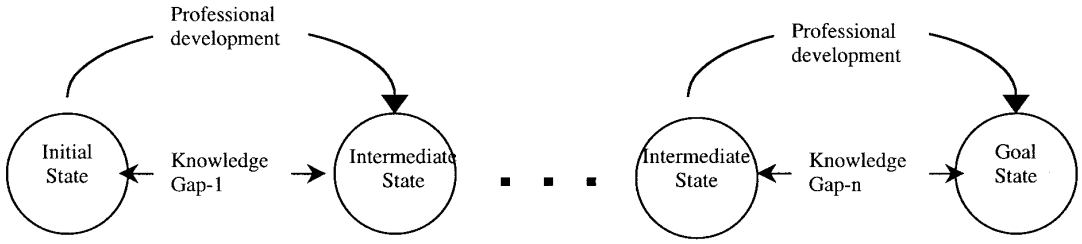


Figure 2. The professional development process in operation provides the means for a teacher to move along a sequence of knowledge states toward her personal goal.

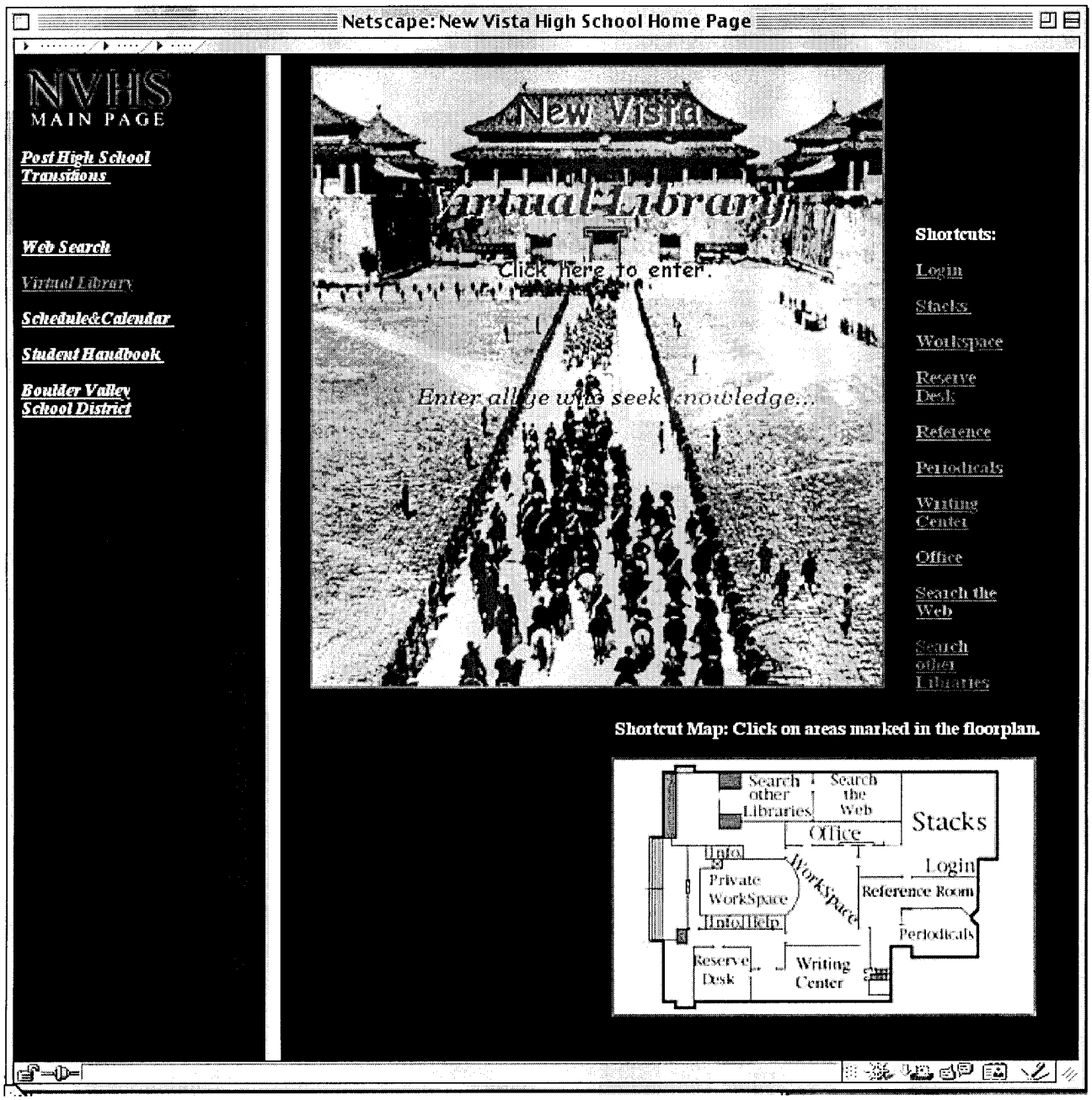


Figure VL. Screen shot of the welcome page for the Virtual Library that grew out of one of the Working Shops teams.