Supporting community-based learning: case study of a geographical community organization designing its website

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Community computing supports human–computer interaction among neighbours in geographical or place-based community organizations. Using a case study of such an organization, we investigate the process of designing their website. Our long-term participatory design approach, integrating developmental informal learning, allowed us to understand how this community organization adopts, evaluates, and sustains website technology. Based on our case study analysis, we present three design heuristics for developing community-based technology: align and afford new possibilities for participation, dynamically manage organizational knowledge and learning, and enhance social capital within community organizations and with the broader community.

Keywords: Community computing; Long-term participatory design; Developmental informal learning; Sustainability

1. Introduction

As the internet becomes more embedded in our daily lives, it is critical for community organizations to have a web presence to disseminate information effectively and efficiently to the public, to discuss issues related to regional economic development and social services, and, most importantly, to be able to connect and stay connected with the larger geographical community. In this paper, we report a case study of a local community organization, Spring Creek Watershed Community (Spring Creek), designing their website to achieve such goals. In working with Spring Creek, we followed a participatory design approach in which we qualified our role as facilitators and technology consultants in the design process rather than technology providers or programmers. Through such roles, a fabric of informal learning was introduced in which members of Spring Creek analysed, designed, and managed their website in the long term.

Community-based learning can refer to a variety of forms of learning, both formal and informal, in the context of individuals, groups, and communities (see discussion in Stahl 2003). We are interested in informal learning in the context of community computing. Although learning is closely associated with schools and classes, most of the learning in our lives actually takes place outside the control and confines of formal education (Brookfield 1984, Caffarella and O'Donnell 1987). Informal learning is manifested in daily meaningful activities in the context of our home, work, social life, and community-based outreach. It occurs continuously throughout life, requiring no particular preparation (Dewey 1966).

From our interaction with Spring Creek, we learned how a community organization adopts, evaluates, and sustains website technology. Our contribution in this paper is the case study analysis, based on which we propose three design heuristics for developing website technology. These heuristics present possible socio-technical design interventions which consider the unique characteristics of geographical community organizations, such as their lack of resources of all types (e.g. money, technical skills, technology infrastructure). Our paper is also an empirical

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contribution to the study of community-based learning because of its more specific focus on geographical or place-based community organizations instead of online communities (e.g. community networks), professional communities (e.g. community for teacher professional development), or educational communities (e.g. school settings).

The paper is organized as follows. Section 2 reviews related literature pertinent to the design context of community organizations. Section 3 describes our participatory design approach to work with community organizations to design technology collaboratively. Our premise is that engaging community organizations in more meaningful and long-term design activities will enable them to become a part of everyday information technology literacy. Section 4 gives a background of our case study and describes the research methods. Section 5 provides details of the case study and its analysis. In section 6, we present three heuristics for designing website technology based on our analysis of the case study. We provide some concluding remarks in section 7.

2. Literature review: design context for community organizations

Community computing supports human–computer interaction among neighbours (Carroll 2001). It refers to socio-technical interventions to support community interactions and civic activities among participants living in physical proximity and sharing common resources. Examples of such geographical or place-based community organizations are a local food bank providing emergency food and clothing to those in need or an animal rights group protecting rare birds from extinction near an excavated site.

Community computing settings are viewed as a distinct domain containing activities and practices that differ from workplace and educational settings. While there is certainly overlap between these domains, the impetus is to discover the ways that community context impacts on user requirements, system design, and socio-technical practices. There have been a number of attempts within the human–computer interaction (HCI) and computer-supported cooperative work (CSCW) communities to organize researchers around the community computing research area, including several workshops (ECSCW 1997, Community Networks: Opening a New Research Field for Cooperative Work; ECSCW 1999, Broadening Our Understanding: Community Networks and Other Forms of Computer Supported Community Work; CSCW 1998/PDC 1998, Designing Across Borders: The Community Design of Community Networks), conferences (Communities and Technologies Conferences 2004 and 2005; Global Community Networking: Building an Internet for Citizens, 2000; Global Community Networking II: World Congress of Citizens’ Networks: Renewing Communities in the Digital Era 2001), special issues of journals (Computer Supported Cooperative Work, 7 (3/4)), and the development of a new journal devoted to community computing (Community Informatics Journal).

While there have been calls to study community computing contexts, there are few studies that attempt to describe how geographical community organizations appropriate technology. We are concerned with finding ways to support technology use, design, and learning in community organizations as they work to achieve social and communitarian goals. Technology plays an important role in community organizations, enabling them to advertise services, communicate their mission, and recruit volunteers. Despite this importance, community organizations often face significant challenges when implementing technology in their organization (Benston 1990, Balka 1995, 1997, McPhail et al. 1998, Mogensen and Shapiro 1998, Robertson 1998, Trigg 2000).

In community organizations, technology decisions are often driven by the availability of scarce resources including few full-time staff members, limited (or non-existent) technology budgets, little grant funding, and a constrained pool of technically skilled volunteers. Community organizations often make use of off-the-shelf solutions and have to live with a system even if it is not optimal because of the trade-offs involved in trying out a new system.

A number of strategies have been suggested to carry out technology design projects in community computing effectively. Kyng (1988) suggested a number of strategies that can be used with resource-poor groups, such as: (a) sharing stories and conducting workplace visits to demonstrate how technology might be used in an organization; (b) finding models for local work; (c) using futures workshops to help people envisage and plan for potential changes in work practice; and (d) using mock-ups which make design decisions more concrete. These strategies are exemplified by a number of studies within CSCW that describe technology projects with non-profit organizations. For example, Trigg (2000) created a database that served as an in-house ‘sandbox’ to try out design ideas for a non-profit organization. Robertson (1998) served in an advisory capacity helping an organization think through some of the ‘shopping’ decisions involved in choosing a new technical system. Mogensen and Shapiro (1998) worked with groups to expand their technology thinking by presenting alternatives to solve problems that organizational members encountered in their everyday work. McPhail et al. (1998) used a future’s workshop and demonstrations to elicit user participation.

In our work, we try to push the line between user and designer further by finding ways of encouraging the development of design and technology planning expertise within the work practice of community organizations. The next section explores our methodological approach for working with community organizations.
3. Methodological approach: integrating learning with long-term participatory design

Participatory design (PD), which originally emerged from socio-technical systems theory (Mumford 1983), is a practice among design professionals which explores conditions for user participation in the design and introduction of computer-based systems in organizations (for a detailed discussion, see Greenbaum and Kyng 1991, Clement and van den Besselaar 1993, Schuler and Namioka 1993, Kensing and Blomberg 1998). Concurrent with designing technology that facilitates communitarian goals, we are also interested in how community organizations learn technology and change or refine their practices to sustain their learning over time.

Much literature on PD emphasizes that mutual learning by developers and users is an outcome of successful partnerships (e.g. Ehn and Kyng 1991). Carmel et al. (1993) mention that one of the themes in PD is mutual learning (Floyd et al. 1989), in which users and designers teach one another about work practices and technical possibilities through ‘joint experiences’ (Kyng 1991, Clement and van den Besselaar 1993). It has been acknowledged that mutual learning is not a separate activity but an inherent characteristic of the design activities in PD (Irestig et al. 2004).

Whereas PD researchers generally maintain the consensus that learning is a part of PD, it is less clear what the nature of learning is during the design process. Traditionally, PD brings users and designers together in mutual commitment, where the users learn about technology in order to understand what computer technology can do for them, and designers learn about the application domain in order to build a flexible and efficient system to fit the users’ needs (Bjerknes 1993). Such views of learning in PD, argue Carroll et al. (2002), are quite singular and ephemeral. Rather, a ‘developmental’ view—in the sense of Piaget and Inhelder (1969) and Vygotsky (1978)—of learning should be adopted in which users develop qualitatively different roles through the course of long-term collaborative design process with designers. In the study by Carroll et al. (2002), teachers went through transitory roles from being informants to analysts, designers, and eventually coaches. This developmental process was engendered by active contributions on the part of users and designers in co-constructing and engaging in meaningful activities. Other arguments for the developmental perspective of PD have also been made (e.g. Bodker and Gronboek 1996, Bodker 1999, Beguin 2003).

In considering learning in PD from a developmental perspective, the issue of sustainability becomes critical (Kensing and Blomberg 1998). Clement and van den Besselaar (1993) note that when designers leave, the participatory processes seldom diffuse to other organizational entities. They argue that users must increasingly gain in their ability and willingness to take on the roles of designers. PD projects are increasingly developing knowledge management strategies and techniques to help sustain the participatory process after designers depart or fade (e.g. Bodker 1996, Kensing et al. 1998).

Our approach to PD incorporates developmental and informal learning as argued above. We take a long-term PD approach which combines ethnographic fieldwork with participatory design to develop community-based technology (Carroll et al. 2000). Learning is inherent in our approach, where community members are engaged in self-directed and relevant design activities, gaining in their capacity to become more technology skilled through hierarchical and lateral forms of learning (Farooq et al. 2005). At the same time, we as designers explore different roles such as facilitators and technology consultants in the design process to support their learning goals (Carroll 2004). Our PD approach is guided by the goal to achieve sustainability (Carroll and Farooq 2005, Merkel et al. 2005). We work to achieve sustainable design, learning, and work practices which inject a sense of designer independence on the part of community organizations as we fade from the process.

4. Case background and research methods

Our case study is part of the Civic Nexus community computing project. Civic Nexus is a 3-year participatory design project with the goal of working with local community organizations in Centre County, Pennsylvania, USA, to increase their ability to solve local community problems by leveraging and enhancing their capacity to use information technology (Merkel et al. 2004). Each year we work intensively with a cohort of about four community organizations. We begin with ethnographic fieldwork to understand how technology is used in an organization and how it fits with their values and work practices. We then collaborate with the organization to select a technology project that we work on together over the course of approximately a year. During the concluding stages of the technology project, we gradually fade from the process in an effort to allow the community organization to manage and guide their existing and future technology endeavours.

Spring Creek was one of the organizations we focused on during the first year of the project (2003–2004). The following is a brief description of the organization.

4.1 Background: Spring Creek watershed community (Spring Creek)

Spring Creek (http://www.springcreekwatershed.org) is a community organization located in State College, Pennsylvania, USA. The mission of Spring Creek is to promote actions that protect and enhance the quality of
life, environment, and the economy throughout the watershed while maintaining and improving the high quality of Spring Creek and its tributaries. Their website is a way to achieve their strategic goals of increasing public awareness of watershed issues through education and communication, enhancing intergovernmental and interorganizational cooperation, and maximizing involvement and participation in Spring Creek actions.

Spring Creek was founded in 1997 through a grant from the Pennsylvania Department of Environmental Protection to Clearwater Conservancy, a stakeholder group of Spring Creek. The 14 Spring Creek Watershed municipalities recognized the importance of sharing watershed challenges and concerns with each other and came together voluntarily to form the Spring Creek Watershed Commission. Elected or appointed officials from these municipalities gather every other month to discuss watershed issues and work to promote watershed cooperation. They jointly sponsored several important projects, the most notable being the development of a Spring Creek Watershed Plan. This integrated water resources management framework coordinated projects of stakeholders throughout the Spring Creek Watershed Community, including not only municipal partners and authorities but also non-profit organizations, educational institutions, the development community, and private citizens.

Watershed planning is a challenge because the units of government charged with land use planning are different from the geographical units defining natural resources. However, with increasing awareness of water resources and other ecological systems and their fragile nature, cooperative planning and decision-making among Pennsylvania municipalities will become not only more accepted but increasingly promoted as the most logical method of managing water resources and ensure their protection for the health, safety, and welfare of the citizens of Pennsylvania.

Like most community non-profit organizations (Benston 1990), Spring Creek has limited staffing and financial resources. Table 1 lists the key players in Spring Creek with whom we interacted with. Spring Creek has only one paid staff member, who works for Clearwater Conservancy. This staff member, Lauren, is compensated by Clearwater Conservancy for dedicating 15% of her time to Spring Creek in the capacity of its lead coordinator. Emily was a full-time staff member for Clearwater Conservancy. Her role was to lead the Water Resources Monitoring Project, started by Spring Creek to establish baseline data to be used for longer-term protection of Spring Creek and its tributaries. Financial support for the monitoring project came from a variety of watershed stakeholders including industries, institutions, municipalities, authorities, and foundations. Andy was an undergraduate student at a large university in Centre County. As a student, he was required to complete an internship as part of his program requirements, which he took up through a volunteering position with Spring Creek. Richard was a volunteer for Spring Creek and Clearwater Conservancy with an interest in enhancing the technology capacity of Spring Creek. The volunteers were not financially compensated.

4.2 Methods

4.2.1 Data collection. Research access was granted in October 2003 during a workshop in which we invited potential community organizations, including Spring Creek, to partner us on the Civic Nexus project. Spring Creek expressed their interest in working with us. The field research was carried out during a period of approximately 14 months up to November 2004. Although our direct involvement faded after this time, we continue to monitor the progress of Spring Creek with respect to their website technology.

Because our methodological approach was guided by participatory design, the primary method of data collection was observation recorded through field notes. However, observations were not just passive. We assumed a variety of roles within the case study situation and participated in the events being studied in the capacity of different roles (Yin 2003, pp. 93–94). Our research method more closely resembled action research. We attended Spring Creek’s website committee and other technology-related meetings, each lasting about an hour. During observation, we assumed active roles such as facilitators and technology consultants, consistent with our participatory design approach. We also made direct observations during which we adopted slightly more passive roles, such that we were observing activities and their dynamics but not taking part in them. Secondary sources of data collection included documentation (e.g. meeting agendas, meeting minutes, and newsletters), archival records (e.g. emails and

Table 1. Key players in Spring Creek.

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Background</th>
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<tbody>
<tr>
<td>Lauren</td>
<td>Lead coordinator for Spring Creek</td>
<td>Limited technical background, trained in non-profit management</td>
</tr>
<tr>
<td>Emily</td>
<td>Staff member for Clearwater Conservancy working on Spring Creek’s website</td>
<td>Limited technical background, trained as biologist</td>
</tr>
<tr>
<td>Andy</td>
<td>Volunteer intern from university for Spring Creek</td>
<td>Technically proficient, trained in computer science</td>
</tr>
<tr>
<td>Richard</td>
<td>Volunteer for Spring Creek and Clearwater Conservancy</td>
<td>Technically proficient in web technologies and databases</td>
</tr>
</tbody>
</table>
websites), and physical artefacts (e.g. design mock-ups and scenarios).

We conducted two semi-structured interviews with Lauren and one with Emily which lasted approximately an hour each. We focused on Lauren and Emily because they were the primary stakeholders of Spring Creek and were non-volunteer members of the organization (paid staff members or in charge of the decision-making process). The interviews were tailored to each person and focused on their perception of what happened and why in relation to Spring Creek’s website, on how decisions and actions were influenced and made, on what conflicts arose and how they were resolved, and on their particular role in the design process. The interviews were tape-recorded and subsequently transcribed. Additionally, data were collected through both face-to-face interactions and phone conversations with Lauren and Emily.

4.2.2 Data analysis. The data collected were analysed using the general analytic strategy of developing a case description (Yin 2003). Although the objective of the study was not a descriptive one, a descriptive approach was followed to help identify the complex stages of designing a website and how we as researchers scaffolded this process using the participatory design approach summarized in section 3. Our perspective on participatory design as a learning process guided our analysis of the data, reflecting important socio-technical elements of designing a website. However, the data were also used to inform the participatory design approach itself, in that the design emerged as an iterative process taking place throughout the data collection and analysis phases. For example, the idea of ceding ownership was developed at a fairly late stage after analysing Spring Creek’s insistence on us designing their website, and realizing the importance of sustainability in community settings.

4.2.3 Data evaluation. In order to ensure the rigour of our results, we triangulated the multiple sources of data collection. To ensure reliability and plausibility of our results, all our field researchers met biweekly with others in the Civic Nexus research group to report the field observations. The research group reflected on the collected data to generate collaborative interpretations. This collaborative process of data analysis helped to remove the individual researcher’s subjective bias, thus increasing the reliability of data analysis.

To achieve investigator triangulation, a number of researchers from Civic Nexus attended meetings to converge on the interpretations that were being made about Spring Creek’s website design process. The reporting of the experience with Spring Creek in this paper is from the researchers’ perspective of the dynamics that occurred within Spring Creek during their website design process. Member checking was performed in our research, where we presented our analysis for feedback from Spring Creek, accounting for our bias in interpretation of the community context and the process of website design.

One research issue we encountered was anonymity. We have used the actual name of our case study organization, because we feel that knowing information about their website, specifically the URL and back-end system, is critical to understanding the issues that revolve around designing a website. However, we have anonymized the names of Spring Creek’s key players to protect their real identities.

Because of the particular methodological perspective we adopted in our fieldwork, another critical research issue we faced was the difficulty involved in trying simultaneously to encourage change and observe change. It would often happen that we would be actively engaged in solving a problem with the organizational members (e.g. helping them understand how to upload files to a web server), which would render it difficult to take field notes related to that particular situation. In such cases, we often tape-recorded meetings for later reflection and analysis, and had several researchers in the field for different tasks (e.g. one researcher engaged in problem solving and the other taking field notes).

Our methodological approach of long-term participatory design obviously has several challenges. These challenges are discussed in previous work (Merkel et al. 2004). For example, our role as researchers co-evolved with emerging practices of the community organization. In some cases we adopted more passive roles where we simply observe community settings, and in others we adopted more active roles where we co-constructed joint activities with our community partners. As such, it became difficult at times to gauge the level of our influence on community practices. We regularly teased out such influences in our research meetings and through member checking, as mentioned before.

5. Case description and analysis

This section contains the description and analysis of the case study. The first subsection is a prelude, since it provides an overview of the events from October 2003 to November 2004. The remaining three subsections analyse the process of adopting, evaluating, and sustaining website technology by Spring Creek. Specifically, these sections address the use of content management systems to develop and maintain websites. Content management systems allow collaboration creation of web content.

Prior to Spring Creek’s use of content management systems, other significant events took place related to the design of their website. For example, Spring Creek first tried to understand what ‘design’ meant and subsequently
analysed their website to elicit design requirements. In another instance, Spring Creek used techniques such as scenarios to design the content and layout of their website. We mention such events in the overview to give readers a background, but we do not analyse them because this has already been done in our previous accounts (see Farooq et al. 2005, 2006). Moreover, analysis of Spring Creek’s website technology, on which we focus, is more relevant to this special issue.

### 5.1 Overview of events

Prior to our involvement, Spring Creek’s website was developed and maintained by a commercial vendor. Spring Creek’s goals on the website were misaligned with their actual mission. The vendor projected them as a stereotypical environmental preservation group, whereas they sought to express their actual goals: local economic planning, influencing decision-makers, and encouraging quality of life through watershEds. The situation was even more frustrating for Spring Creek because they did not have control of their website. They did not have administrative rights to their website nor were they technically skilled enough to update it themselves. Furthermore, the vendor was not willing to update the website in accordance with Spring Creek’s requests.

To address these concerns, Spring Creek began to initiate actions to take control of their website themselves. During October 2003, Lauren formed a website committee for Spring Creek. In November 2003, the first website committee meeting was held, led by Lauren and attended by many volunteers interested in working on Spring Creek’s website. During this meeting, Lauren explained the need to redesign the website. This meeting provided the foundation for seven subsequent website committee meetings. Table 2 gives a summary of all these meetings.

<table>
<thead>
<tr>
<th>Meeting (date)</th>
<th>Meeting agenda</th>
</tr>
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<tbody>
<tr>
<td>Meeting 1 (1 November 2003)</td>
<td>Introduction of committee members; Lauren explains purpose of forming committee</td>
</tr>
<tr>
<td>Meeting 2 (15 November 2003)</td>
<td>Discussion of possible hosting services for website</td>
</tr>
<tr>
<td>Meeting 3 (13 December 2003)</td>
<td>Website host decided; Lauren to collect website content; Andy, intern for developing online newsletter, introduced to the committee</td>
</tr>
<tr>
<td>Meeting 4 (7 February 2004)</td>
<td>Review of mission statement; committee focuses on developing website content</td>
</tr>
<tr>
<td>Meeting 5 (21 February 2004)</td>
<td>Negotiation between designing content versus layout; review of Andy’s progress on newsletter submitted via email</td>
</tr>
<tr>
<td>Meeting 6 (6 March 2004)</td>
<td>Identification of three audiences for website; Civic Nexus researchers suggest using scenarios to articulate needs of these audiences</td>
</tr>
<tr>
<td>Meeting 7 (20 March 2004)</td>
<td>Compared and contrasted other websites resembling Spring Creek’s mission; layout of front page discussed</td>
</tr>
<tr>
<td>Meeting 8 (3 April 2004)</td>
<td>Lauren reads her scenario to design front page; design of front page begins using paper mock-ups; discussion of using wiki to prototype website</td>
</tr>
</tbody>
</table>

**Table 2. Summary of website committee meetings.**

What happened:

1. We outlined how I was going to leave our current host and then switch to our new host.
2. We finalized the draft mission statement.
3. I was assigned the task of compiling the first batch of content.
4. We agreed on assignments for Andy (our new intern) – create a proposal for the newsletter.
5. We agreed that the committee should meet in January.

During the fourth and fifth website committee meetings in February 2004, the content of Spring Creek’s website started to emerge. Many discussions were held between the committee members, specifically related to the confusion between the concepts of designing for content and designing for layout. The outcome of these discussions was the decision that content for the website should be designed first, focusing on the core message of Spring Creek. Layout was to be designed once the content was finalized.

At the end of the fifth meeting on 21 February 2004, Lauren forwarded an email from Andy to the website committee regarding the design of the newsletter. Lauren wanted feedback from the committee on Andy’s newsletter proposal (referred to as the ‘document’ in the email).
Following is an excerpt from the email from Andy to Lauren:

Been working on the external design for the newsletter. Ran into a few things I’d like to get your feedback on before I proceed.

Could you email me the updated mission statement for the website as I’d like to incorporate that into the document...I just want to make sure that the document meets your goals.

Also, take a look at browser based WYSIWYG (‘What You See Is What You Get’) editor link below...

I am interested in your thoughts regarding the usability of the WYSIWYG...

The newsletter proposal was quite comprehensive, detailing requirements specifications and Andy’s responsibilities over the next few months. The objective of the 13-page proposal was the following (taken from proposal): ‘The purpose of this document is to provide the system overview and specifications and present the baseline requirements for newsletter development’. The proposal was divided into four sections: Section 1—Overview of the project; Section 2—Functions and framework of the newsletter application; Section 3—Detailed look at newsletter publishing cycle (creation, publication, modification); Section 4—Project timeline.

In parallel with Andy’s work on the newsletter proposal, three website committee meetings were held in March and April. The result of these meetings was that the website content was finalized and the layout was discussed. Various paper mock-ups were presented as alternatives in the eighth meeting.

We (the Civic Nexus researchers) suggested the use of wikis—online WYSIWYG editors for editing web pages without knowing much programming—to model the paper mock-ups so that Spring Creek could see the consequence of implementing them through prototypes. We did not want to overlap with Andy’s work on the newsletter design, as he was also using a WYSIWYG editor similar to a wiki. After discussing this situation with Lauren, she decided to contact Andy to ask whether or not this would be an issue. Following is an email reply from Andy to us on 6 April 2004:

No I am not working on the design (of the website). Feel free to model it as you wish. If you’d like some feedback, send the layouts out to me.

Following this email, we created three different templates for Spring Creek’s website on our system known as BRIDGE (Basic Resources for Integrated Distributed Group Environments, http://bridgetools.sourceforge.net) (Ganoc et al. 2004). The BRIDGE infrastructure is seamlessly integrated with browser-based wiki-style asynchronous editing. For accessibility and familiarity, BRIDGE client systems look and behave like a normal website, with all content rendered as HTML and images. Simple forms of authoring are supported. Each page has an Edit link which supports editing and new page creation using a simple shorthand notation which requires no external authoring tools or knowledge of HTML.

At the end of April, we emailed these website prototypes to Lauren. In early June, we met Lauren and explained how to use the system to edit the web pages, add menu items, create links, and so forth. Lauren preferred the third website template we developed (http://java.cs.vt.edu/public/users/ufarooq/Spring+Creek/Sample3/index.html).

We had only created a few menu items and links on this website so as to provide a minimally detailed and basic template for Spring Creek to start adding richer content. Lauren and Emily started adding content during June, July, and August 2004. They designed the logo, added hyperlinks to the website, contributed significant content (e.g. a historic timeline of Spring Creek, details of the Water Resources Monitoring Project), and much more. We also met with Spring Creek in early August to improve our understanding of their use of our system and gauge requirements for enhancing BRIDGE to support their activities further.

Because the website was nearing completion, Lauren wanted an update from Andy regarding the newsletter so that it could be uploaded to their website on BRIDGE. She sent the following email to Andy on 12 August 2004:

Here is the link to our ‘final draft’ of our website... As far as the site design goes, I would say it is done and that you can use this style to finish the newsletter... We are planning on going live with it in early September after the newsletter is done.

On 14 August 2004, Lauren received a response from Andy that put the future direction of the website redesign project in doubt. Instead of just creating a system to handle online newsletters, he had produced a prototype in which he had redesigned the whole website. Following is the email reply from Andy:

With time running out I decided to make the whole effort worthwhile. I’ve configured and modified an open source content management system to suit your needs:

**Not just for newsletters but the entire website.**

This ‘surprised’ Lauren, as was indicated in one of our transcribed phone conversations with her and Emily on 18 August 2004:

My understanding is that he was done with his internship at the end of August period. And so when
he sent me those emails [referring to Andy’s emails], I was really surprised because he was telling me that he was really busy.

Spring Creek now had to make a decision between BRIDGE, which had already been used to create significant content during the summer (June – August 2004) by Lauren and Emily, and Andy’s open-source content management system Mambo (http://www.mamboserver.com). Mambo, like BRIDGE, allowed management of websites by any administrator or authorized user. Only the super-administrator and administrator needs a high level of technical knowledge in Mambo; the manager, user, and guest use a WYSIWYG editor to interact with the website.

Because she was unfamiliar with Mambo and its capabilities, Lauren approached us for advice about which system she should choose. Following our participatory design approach, we did not want to make the decision for Spring Creek. Rather, we wanted to help them discover the pros and cons of both systems and eventually resolve the situation on their own.

We subsequently met with Andy, Emily, and Lauren in September 2004 so that Andy could explain the functionalities of his system. During this meeting, we provoked questions on behalf of Spring Creek, asking Andy to explain how Spring Creek would update a webpage or upload a picture. The outcome of this meeting was exploratory. After this meeting, Lauren and Emily decided to give Andy’s system a try, and thereafter emailed him asking specific questions about using Mambo. In October, Lauren and Emily met with us and specifically asked us what Spring Creek should do to decide between BRIDGE and Mambo. We remained resolute, using the utmost care so as not to bias them towards any one system, and encouraged them to think about the consequences of using BRIDGE and Mambo. For example, we asked them to consider how Spring Creek will maintain BRIDGE and Mambo after we fade from the research setting and Andy moves on.

After this meeting, Spring Creek decided to develop their website with Mambo. The content from BRIDGE was ported to Mambo and further refinement was carried out. We interviewed Lauren and Emily individually during November to understand their rationale for choosing Mambo over BRIDGE and their decision-making process. This allowed us to compare socio-technical elements of two content management systems and glean in-depth requirements for designing website technology for community organizations.

Spring Creek’s current website is using Mambo’s content management system (http://www.springcreekwatershed.org). Lauren and Emily, among others in Spring Creek, now manage the website in-house by themselves without relying on any specific technical volunteer. The decision-making they had to do required and motivated learning and the development of critical information technology skills, which is probably more important and significant than the decision itself.

We now analyse our data regarding Spring Creek’s adoption of BRIDGE, evaluation of BRIDGE and Mambo, and maintenance of their current website.

5.2 Adoption of content management system

Content-management systems like BRIDGE and Mambo are end-user development tools. End-user development is about non-developers and non-programmers exercising greater control over technology, such as enabling design of computer-based applications without becoming entangled in the nitty-gritty of programming (Sutcliffe and Mehandjiev 2004). Our rationale for introducing BRIDGE to Spring Creek was to enable end users like Lauren to become an integral part of designing their website so as to emphasize their organizational values as it related to their organization’s mission (Farooq 2005). One of the tensions we had in mind was that members of community organizations rely on help from volunteers and have a strong tendency to want experts to use technology (Benston 1990). This is because they have little time to devote to technology, as indicated by the following quote from an interview with Lauren:

This isn’t a funded project; I’m basically volunteering my time… We don’t have time to learn this (referring to technology).

One reason BRIDGE was used extensively to design Spring Creek’s website was the minimal cognitive overhead needed for its use. Furthermore, the benefits of using a wiki-like system were apparent, as it required little learning and less time to achieve tangible results. Although we realized the benefits of BRIDGE for Spring Creek, we did not impose technology on them but allowed them to assess how it fits with their organizational practices (Trigg 2000). At the time when we introduced BRIDGE to Lauren, she was extremely enthusiastic about using it and remarked:

This (referring to the wiki-like functionality) is just motivating me… you’re putting something in front of me that I can use.

After becoming more familiar with BRIDGE, Lauren indicated her desire to leverage volunteers to manage the website:

What I would like to do eventually is once we get the site in a manageable point, I would like to have a volunteer or two volunteers who are willing to update the site regularly.
However, relying on volunteers carries its own baggage of problems. For example, in one of the interviews, Lauren from Spring Creek remarked about volunteers who might not fully understand their mission in their limited participative time, and how this might have adverse effects on their organization:

Like there’s this one volunteer who I would like to be able to have him do certain things on the site, but I don’t trust him… If he only had control over that one thing so he’s not promoting his own agenda, that would be good… You don’t want somebody to be able to go in and screw up your site.

In June 2004, Lauren involved Emily in starting to add content to their BRIDGE website. At this point, before Emily could even add content, it was difficult for her to log in using BRIDGE as indicated by one of her emails to us:

Lauren gave me a list of things to add to the website (she left for the day) and I cannot seem to log on to the site with her name and password. Do you know what her password is? (I can tell you what she told me it was).

Even though there was some coordination between Lauren and Emily, helping Emily to start using technology took some effort. Part of this was because of the diverse skill set of community organization members—Emily was not familiar with website technology. After creating a user name and password for Emily, her reply to us was:

Thanks! I am new to the world of websites so I am sure that you will be hearing from me soon.

Indeed we did. We facilitated Emily in adding content to Spring Creek’s website. Some activities that Emily learned while using BRIDGE were linking web pages, adding hyperlinks, and creating menu items.

5.3 Evaluation of two-content management systems

The months of August, September, and October 2004 were challenging for Spring Creek. After a surprising email from Andy announcing that he was redoing the whole of Spring Creek’s website, Lauren and Emily had to decide between BRIDGE and Mambo. The ‘look and feel’ of Spring Creek’s website on Mambo was similar to that on BRIDGE, because Andy had simply imported the content (figure 1).

The tension for Spring Creek in making their decision was related to the learning and effort that Lauren and Emily underwent over a few months to acclimatize to BRIDGE. In a later interview with Emily during November 2004, she reflected on this:

At first, neither of us [Emily and Lauren] wanted to switch… I was very reluctant because I had been the one that put up most of the content on the website.

Further, Lauren perceived Andy’s effort as futile to some extent because Spring Creek was so close to going ‘live’ with their BRIDGE website in September 2004. During our phone conversation on 18 August 2004, Lauren remarked:

It sounds like to me what he [Andy] just did is a big duplication of effort. I saw this stuff on Sunday [referring to Andy’s emails] and I was kind of upset because I kind of felt like we were headed down a successful road and… this now a fork… I just feel like we are so close to being live in September and this just seems huge.

During our interaction with Spring Creek, we noticed the tension between valuing volunteer participation, specifically Andy’s work with Mambo, and choosing BRIDGE. In an informal phone conversation we had during the first week of September 2004, Lauren addressed her concern that if she goes with Andy’s system, would we ‘have any bad feelings’ in working with Spring Creek. We clearly expressed our position, stating that we would facilitate Spring Creek irrespective of their decision under the rubric of our Civic Nexus research project. Lauren responded, ‘I appreciate this’.

Sustainability was Spring Creek’s primary concern during their decision-making process. They had already experienced a lack of control over their technology (website) with the previous vendor, and did not want to be left in the same position. In our phone conversation on 18 August 2004, Lauren expressed this concern:

I think that we’re capable of using either system from first glance. I mean it’s way better than it ever was [referring to the situation of having a choice between two systems]… but again, I didn’t try his [Andy’s] system… so that’s one thing. The second thing…my big concern is… am I gonna end up in the same situation [referring to their previous website and being dependent on a vendor] because is he [Andy] gonna be there for support?

Functionally, BRIDGE and Mambo are quite similar; they both support WYSIWYG web page editing, accounts management, and file management, among other features. The major difference between BRIDGE and Mambo was that at the time, BRIDGE was not released as an open-source system, whereas many users had already embraced Mambo in the open-source community. We were clear about this matter with Spring Creek, explaining to them how the use of an open-source system is one facet of...
achieving sustainability because of the wide user base and helpful online resources like forums. Being reasonably comfortable with the idea of seeking future help from an open-source community at this point, we and Andy met with Spring Creek in September 2004 to experiment with Mambo and assess its usability. Prior to this, Andy had not met with Spring Creek to explain Mambo’s functionality. Lauren was concerned with the ‘ability to change stuff on our own [referring to Spring Creek]’. Emily, who had significantly developed content in BRIDGE, was proactive in asking Andy about Mambo’s features:

Could you explain just like the hierarchy of this system like a category versus an item versus what’s a
section...I think because that would help me figure out how I need to put things in there [referring to adding content and structuring the website directories].

After this meeting, Spring Creek adopted Mambo as their website content management system. In a later interview with Lauren in November 2004, we asked her to reflect on her decision-making process between BRIDGE and Mambo. In fact, she preferred BRIDGE to Mambo in terms of usability, but felt that Mambo was more sustainable in the long-term, as indicated by her response:

Aesthetically, I liked yours better [referring to BRIDGE in comparison with Mambo]...it was really hard [referring to the decision] because I liked the way yours looked better. When you look at the management of files over time, I felt like that (referring to Mambo) was probably going to be easiest...I don't even know if it was a good decision...Even though it's not really what I probably want to do, because its easier to stay with this one [referring to BRIDGE], but long-term...I hope we made the right decision [going with Mambo].

Spring Creek quickly learned Mambo, its administrative functionalities, and its website management capabilities. From September to November 2004, Emily and Lauren actively used Mambo to develop their website, importing much content and layout information from BRIDGE. It was clear that Spring Creek had now decided to go with Mambo as their community-based technology.

5.4 Maintenance of website

After we met with Spring Creek and Andy in September 2004, to date no one has heard from him again, despite Lauren’s many attempts to contact him via email and phone. From our perspective, this was similar to Spring Creek’s earlier situation when the vendor created their website but never maintained it. However, this time Spring Creek had control of their technology. In a matter of weeks, after this meeting with Andy, Emily was actively using Mambo forums to help herself learn the ropes of Spring Creek’s newly adopted community-based technology. When asked in an interview in November 2004 how she learned Mambo and what kind of resources she used, Emily replied:

I rely heavily on the Mambo forums. I love forums because you’re anonymous...The Mambo forums have been great. I have been printing out everything they send me.

To us, this was an indication of at least two things. First, leveraging forums was a way for Emily and potentially other Spring Creek members to bridge social capital with Mambo’s online open-source community. Secondly, Emily felt more confident in using and learning Mambo as she received friendly and encouraging responses to her questions on the forums. For example, she related an experience in which one of the forum responders read Emily’s profile as a biologist and encouraged her in a subtle manner:

‘I signed in...as a biologist trying to make a website...he [forum responder] said something about ‘I'd rather you be a biologist trying to make a website than a website designer trying to clone a sheep’ [laughter all around during the interview].

We were also interested in how Spring Creek was managing, or was going to manage, knowledge for the purpose of transferring their newly learned skills to other members. This was important because the primary source of the workforce in community organizations is volunteer-ism, which typically implies short-term ephemeral interjections. Thus it is important to train newcomers quickly. Before interviewing Emily, we interviewed Lauren in November 2004 and asked her about any documentation they maintain, to which she responded:

I just gave Emily my folder on the website. I have a folder that has, you know, the committee information, our URL, the server like (information)...(Lauren gets the folder to show the Civic Nexus researcher)...the idea was just to try to get everything so its in one place. So I had all the hosting stuff...I have been building this so I have everything in one spot...Eventually, all the Mambo stuff will be in here.

We decided to probe this further by asking Emily how this documentation could be used. She commented:

If somebody were to come in after me, if I were to leave, it would be easy for me to help them learn this site...I think if we keep documenting the way we do, it will be alright.

Emily also gave an example of training existing staff members to learn Mambo:

We are talking about our office manager...so after we have everything setup, we will show him how to add content....It would also be in Clearwater that everybody would be updating I think'.

After conducting these interviews in November 2004, we gradually faded from the process. We did not meet face to face with Spring Creek, although we have exchanged a few emails with them since then (approximately 10 emails to
date), responding to some of Emily’s technical questions and occasionally asking them about the status of their website. In February 2005, Lauren emailed us about their current status and future plans:

Good news—we recruited a volunteer who is working with other volunteers to create some of the more substantial content. It will take a while for this content to be completed start to finish because they are volunteers, but they are very excited about the new site and have said that it is a big improvement…

You guys really did a great job and I can’t wait for more content to be added to the site.

Based on our data analysis, in the following section we discuss implications for designing website technology. The following points summarize the case study.

- Community organizations value their mission and care about how the larger geographical community perceives them. Misalignment of their projected online goals with their actual mission motivated and seriously committed Spring Creek to modify its learning and work practices, and move toward revamping their technology practices for the collective benefit of their organization and the larger community.

- Community organizations value participation, specifically volunteerism that often comprises diverse (in background, skill set, and so forth) and ephemeral constituents. In our case study, managing these constituencies for Lauren required extra articulation work of coordinating tasks and executing them (e.g. coordinating Andy’s newsletter efforts and adding content to the Spring Creek website).

- Community organizations rely heavily on social capital to fulfill their goals, in the context of both strong and weak ties, at many levels of analysis: individual, group, organizational, and community. In Spring Creek, individuals like Lauren, groups like the website committee, organizations like Clearwater Conservancy, and communities like the online users of Mambo were all engaged in developing and enhancing social capital.

- Members of community organizations often do not have ample time and resources (e.g. access to training) to learn and use technology. This was the case with Lauren and Emily, which motivated and committed them towards technology involving less cognitive overhead for the amount of invested work and realization of the organization and community’s collective benefit.

- For community organizations, knowledge management is even more challenging because of volunteer turnaround and organizational leaders being more absorbed in coping up with fulfilling the organization mission. Lauren and Emily formulated the strategy of developing technical documentation to transfer their knowledge, often specialized and tacit, to others.

- Long-term sustainable use of technology and consequences of its use matters to community organizations. Spring Creek realized this through their experience with the previous website and incorporated the criterion of technology sustains utility in their decisions during adoption and evaluation of website technologies.

6. Discussion: implications for designing website technology

Although community computing goes back to the 1970s (e.g. the Berkeley Community Memory (Farrington and Pine 1997), the Cleveland Free Net (Beamish 1995), and the Santa Monica Public Electronic Network (Rogers et al. 1994)), greater engagement between community computing and human–computer interaction has occurred only recently (see discussion by Carroll 2001). Community settings present new challenges for designing community-based technology, partly because of their civic nature, which is starkly different from traditional workplace and educational settings.

Our case study of Spring Creek adopting, evaluating, and maintaining website technology suggests broader strategies for designing socio-technical interventions. At the most general level, the approach we are pursuing has three design heuristics abstracted from our data analysis. First, we are trying to align and afford new possibilities for participation. This is because community organizations value participation, which is often diverse and requires additional articulation work. Secondly, we are trying to manage organizational knowledge and learning dynamically. This is because community organizations lack resources and face a great deal of volunteer turnover. Thirdly, we are trying to enhance social capital within community organizations and with the broader community. This is because community organizations are embedded within a system of local relationships (intra- and inter-organization) and the ongoing history of their geographical and larger community.

6.1 Alignment and affordances of new possibilities for participation

Part of the value system for community organizations is their consideration for volunteerism. For example, the Johns Hopkins Nonprofit Sector project reported that the number of people working in civil society organizations in the 35 countries they studied exceeds 190 million, which represents over 30% of the adult population in these
countries (Salamon et al. 2003). Valuing participation by community organizations is relevant to adoption and design of technology because it is likely that volunteers will participate in and manage technology-related activities.

Because technology is typically not part of the core mission for community organizations, the use of a community-based workforce creates tensions as the organizations work to harness a diverse set of skills. Volunteers and staff members possess a diverse set of technology skills, which makes it difficult to prescribe a skill set while still being participative (McPhail et al. 1998). In addition, managing such diverse constituents requires additional articulation work, as is evident from our case study. This is because it involves increased coordination of the cooperative work processes and operationalization of subtasks (Gross 1999, Gerson and Star 1986).

Thus one of the concerns for designers of website technology is being able to quickly bring an individual on task within the bounds of the organization’s values and social structure. This is because community organizations often have ephemeral participation from volunteers, staff members, and so forth, and have limited time within which organizational tasks need to be accomplished. Community organizations also need to reconcile the diverse skills and backgrounds that individuals bring with them, while simultaneously focusing on their organizational mission.

Having fail-safe mechanisms embedded in the technology to support privileges for users can address these concerns. One way to achieve this is to separate the organization’s external public view (actual website) from the internal private workspace (testbed for the website), allowing users to try, learn, and assess the consequences of their work without affecting the organizational image. In our case study, Spring Creek used the three templates on BRIDGE to develop their website content and layout. The website templates on BRIDGE allowed Lauren and Emily to moderate and assess the consequences before the changes were actually propagated to the public website. Allowing versioning capabilities to modifications could also help in analysing gradual changes over time. This would support the typical ‘undo–redo’ features of modifying artefacts.

Supporting privileges seems critical in developing website technology for community organizations. For Spring Creek, Lauren wanted a volunteer to update the website after it had reached a manageable point, but simultaneously expressed that trust may be an issue with newcomers. Having granularity in the type of privileges could provide flexibility to leaders of community organizations in delegating their work to volunteers. For example, in addition to role-like privileges to access specific website content, they can be allocated to different groups (e.g. ‘Newsletter group’ for volunteers doing newsletter-like tasks). This could facilitate greater collaboration between volunteers working on similar tasks. Moreover, allowing privileges to change over time can enable technology managers to allocate additional responsibilities as trust gradually builds up.

6.2 Dynamic management of organizational knowledge and learning

By sharing and co-constructing knowledge, individuals contribute to the shared intellectual capital of a community organization (Nahapiet and Ghoshal 1998). Community— the collective storing and sharing of information to which all members of the collective have access—is a consequence of knowledge management (van den Hooff et al. 2003).

Based on our data analysis of Spring Creek’s case description, we noticed that transfer of acquired and learned technical skills is not only more important because of quick volunteer turnaround but also more challenging because of lack of resources to develop such knowledge management practices. One of the practices Lauren adopted in Spring Creek was to document, in one physical folder, all material (electronic and otherwise) related to their website. From our perspective, this was an indication of an attempt to build a knowledge-sharing community (Brazleton and Gorry 2003) for Spring Creek. Lauren’s main concern was that if she leaves, the tacit knowledge related to the organization’s website should be preserved and accessible.

In addition to having a shared information repository, an important part of communality is being able to dynamically access the desired knowledge. This was evident by both Lauren and Emily’s efforts to actively engaging the Civic Nexus researchers and other knowledge bearers (e.g. Andy) through email. Such email exchanges related to both lower-level technical details, such as understanding the structure of the website directory, and higher-level organizational practices, such as how to choose between two website technologies. Emily also used discussion forums to share, co-construct, and dynamically access technical knowledge related to Mambo. Her forum correspondences were not only saved online, but Emily also printed each of these threads to add to Lauren’s physical folder repository.

To support dynamic management of knowledge and learning, one solution could be a repository of electronic artefacts for a community organization. Electronic artefacts could include website versions, emails, discussion threads, and similar products like the ones we observed Spring Creek collect and analyse. This repository could take the shape of a simple file-sharing directory on a common machine in the organization to an online, internal knowledge database that is specialized to the organization’s characteristics and its proximate users.

Dynamic management of organizational knowledge and learning is not just related to accessing artefacts in a
repository but also people who co-constructed these artefacts and their activities. In community organizations, transitioning between volatile members of a volunteer workforce and quickly bringing their skills to bear on organizational tasks is a challenge. One way to dynamically manage and coordinate volunteering activities over time is to maintain an up-to-date repository of volunteer profiles, including their technical skill set, tasks they worked on, documentation of their activities, and so on. This can allow leaders of community organizations to assess how the skills of new volunteers will align with tasks within their organization. In this way, volunteers can be identified based on their niche skill set. This emphasizes the social component of knowledge management, involving identification of people with appropriate skills and bringing these people together to increase learning, organizational knowledge, and communication (see broader discussion in Ackerman et al. 2003).

6.3 Enhancement of social capital within community organizations and with the broader community

In addition to communality, connectivity—the ability to reach other members of the collective—is also a facet of knowledge sharing (van den Hooff et al. 2003). Community organizations must sustain and enhance the original social capital with which they were formed and broaden it into a variety of key areas (King 2004). This is important for the purpose of recruiting and developing board members, raising philanthropic support, developing strategic partnerships with other organizations and the larger community, engaging in advocacy, and creating a shared strategic vision and mission within the organization and its members.

Leaders in non-profit-like community organizations have an important role in developing social capital and, further, investing their already limited time in the right kind of social capital to fulfill their organizational mission (King 2004). At a general level, this involves engagement with both strong and weak ties (Granovetter 1973). Putnam (1993) talks about the ideas of ‘bridging social capital’ to describe the relationships with people outside one’s organization and ‘bonding social capital’ to refer to the relationships that are developed within an organization.

In our case study, Lauren’s attempt to reconcile the decision between BRIDGE and Mambo with both Andy and the Civic Nexus researchers was an example of valuing participation and maintaining social capital. She wanted to satisfy both stakeholders and did not want to lose their goodwill. Her initiative to involve Andy and the Civic Nexus researchers in deciding between the two website technologies was an indication of bridging and enriching social capital. This is corroborated in, for example, research that talks about bridging social capital as especially important in community settings to leverage the power necessary to carry out their agenda (Rosson and Carroll 2003, Kavanaugh et al. 2003).

Emily’s use of Mambo discussion forums was an indication of developing social capital with the broader community. This broader community transcended the geographical vicinity of Spring Creek, as it was an online collective. The availability of such an online community was one of the criteria for Spring Creek to choose Mambo over BRIDGE. In a way, this online community was the critical mass that embraced a particular technology. It was this critical mass that led to Spring Creek’s successful adoption of the technology.

Research in the field of CSCW and artificial intelligence (AI) has created applications that can be understood as technical support for building social capital (Becks et al. 2004). One way for community organizations to enhance social capital is through online social networks. An online social network which extends across organizations and into the larger geographical community may be able to help to locate resourceful people according to their volunteering interests, technical skills, social abilities, etc. With larger groups, such as many organizations or a whole community, it is likely that a recommender system can facilitate faster access to more meaningful resources (see broader discussions in Resnick (2002) and Reichling and Veith (2005)). For example, an expert-profiling feature could connect an organization to skillful volunteers who have specific skills like Java programming and/or can provide advice on technical issues.

7. Conclusion

We adopted a broader socio-technical perspective on how community organizations construe, adopt, design, evaluate, and sustain technology in the context of their learning and work practices. This contrasts, in some ways, with current literature on designing technology to support learning that largely focuses on the individual learner or the traditional role of the classroom teacher (e.g. Palloff and Pratt 2001, Penas-Shaff et al. 2001, Swan 2001, Tu and McIsaa 2002; cited by Klamma et al. 2003a). We used the framework of long-term participatory design to understand and analyse community-based learning, based on the notions of developmental and mutual informal learning and sustainability. We used an in-depth case study of a community organization and illustrated design heuristics and features for developing website technology to support community learning, community work, and community building. Thus this paper offers a new perspective on technological support for place-based geographical learning communities. Although we presented one case study, the discussion around design implications abstracted from it was intended to and can promote constructive debate among the community of designers.
The broader contributions of this paper are twofold. First, we enhance the breadth of empirical studies in context of computer support for learning communities. Few studies have attempted to systematically link community computing to technology design for supporting learning and work practices. Most empirical investigations focus on applications of collective learning environments of students, teachers, and/or professionals, ranging from traditional educational institutions to technology-based experimental facilities (e.g. Klamma and Spaniol 2003, Klamma et al. 2003b, Strobel 2003, Yukawa 2003). Our case study of a proximate geographical community organization, which characterizes many non-profit organizations in the USA (and other places around the world, such as non-governmental organizations in Europe), adds diversity to such empirical collections.

Secondly, we contribute to the understanding of technical aspects in community-based learning. The nuances of the community computing context—such as scarce full-time staff members, high volunteer turnover, and significant reliance on social capital—makes the design space distinct from better-studied settings such as education or workplaces. The design implications and discussion, based on the analysis of our case study, represent first-order approximations to systematically understand the dimensions of designing for community-based learning and work in community computing.

We believe that our paper is of interest to scholars interested in the implications of information technology for community-based interactions and belonging to the broader domains of HCI, CSCL, CSCW, learning sciences, and social informatics. Scholars in community computing can consider the role of long-term participatory design in their own research investigations to engage organizations in meaningful activities and reflect on how our analysis and broader design implications can be useful with respect to their own context. We also believe that our paper is valuable to the general audience of community practitioners and researchers interested in building community capacity using information technology.

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