We are IntechOpen,
the world's leading publisher of
Open Access books
Built by scientists, for scientists

6,900
Open access books available

186,000
International authors and editors

200M
Downloads

154
Countries delivered to

Our authors are among the

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities

CLARIVATE ANALYTICS

**BOOK
CITATION
INDEX**

INDEXED

WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

wConnect: A Developmental Community for Women in Computer and Information Science

Mary Beth Rosson, John M. Carroll, Dejin Zhao and Hansa Sinha

Pennsylvania State University
U.S.A.

1. Introduction

Many girls lose interest in computer and information science (CIS) as they enter their tee-nage years. By the time female students consider college options their interest in CIS majors falls far below that of their male counterparts (AAUW, 2000). One consequence is that in the U.S. the number of women graduating with CIS degrees has dropped by almost 25% in the past ten years (Leonard, 2003). This trend threatens the future availability of qualified CIS professionals, and particularly the diversity and vitality of the profession.

Researchers have explored a variety of interventions to address young women's tendency to avoid CIS topics. For example, pair programming activities have been offered as more so-cially engaging activities for gaining programming skills (McDowell et al., 2003). Depart-ments sponsor female student groups to provide peer support and mentoring for classmates (Edwards, Coddington & Caterina, 1997). Universities often offer summer enrichment expe-riences for pre-college girls (Blum, 2001; Graham, 2004). However, a limitation of these ap-proaches is that they tend to target girls who have already expressed interest in computers or information technology – enough, for example to apply for a summer technology camp. It is much less obvious how to attract the middle and high school girls who have deliberately ignored enrichment opportunities like these.

The wConnect project is exploring *community-building* approaches to increasing the propor-tion of young women interested in CIS activities: our goal is to leverage the social networks young women create and enjoy in their daily lives. Many middle and high school girls hold a narrow and negative view of the computer and information science, believing it to be a field populated by "geeks" who work alone, and on boring computer programming tasks (Margolis & Fisher, 2002). Building from emerging research in the area of social networking systems (e.g., Facebook), we are using friendship networks as a basis for attracting and engaging young women of varying ages in an online community that includes other women working on CIS topics or education. We hope that by so doing we can introduce the young women to a broader, more socially connected, and more personally meaningful view of CIS. Ultimately our goal is to recruit and retain a larger and more diverse population of female students and professionals.

In the balance of this chapter, we summarize our work thus far on wConnect. Most of our research to date has focused on two general goals: designing and delivering workshops to

high school girls, and engaging women at different levels of development in an online community. Prior to describing the workshops and online community, we introduce our research goals, positioning them within other research on women in computing, as well as related work in learning communities. Following this, we describe our specific research activities and outcomes thus far. We close with open issues and general implications.

2. Building a Developmental Community

2.1 Learning Communities

Research over the past two decades has shown the value of learning communities: self-organizing groups of learners who work together on authentic tasks, describing, explaining, listening to, and interpreting one another's ideas. Learning communities structure their learning with both social and tool-based scaffolding (Brown, 1987; Brown & Campione, 1996). Learners develop by participating in the discourse of their community, where they encounter and contribute to the situated negotiation and re-negotiation of meaning.

In a *developmental learning community,* learning takes place through successive phases; members enact developmentally defined roles as they move themselves and other members through these phases (Rosson & Carroll, 2006). Examples are university research groups with undergraduate students, graduate students, post docs, and faculty; or a virtual world containing newbies, members, experts, and administrators. As summarized in Table 1, a defining characteristic of a developmental community is that its members help other members move through the community's phases, even though each member's understanding of the phases may be at least partially implicit. The phases may require skill mastery (e.g., martial arts), with transitions formally acknowledged to mark progress (e.g. "apprentice", "practitioner", "master"). Alternatively, progress may be achieved by meeting a community standard or practice, for example a skill test, a body of knowledge; or it may involve experiences that are recognized as developmental signals by other members (e.g., earning course credits, obtaining a job, conveying some insight about an issue).

Phases: The community is grounded on a sequence of phases that members pass through as they develop community-specific knowledge and skills.
Roles: Members of the community understand the role(s) they should take on given their developmental level, and what this implies with respect to interactions with others.
Motivation: By joining the community, members express their commitment to traversing and helping others to traverse the developmental phases.

Table 1. Essential characteristics defining developmental communities.

Another characteristic of developmental community is the roles that members enact at different developmental phases. They understand what is expected from them during different phases – for example, how to help less-expert members (outreach, scaffolding, other forms of mentoring); reinforce skills at their own level (sharing, comparison, synthesis of experience); and gain support from higher levels (modeling, requesting advice).

Finally, members of developmental learning communities share an orientation toward their own and others' development. By joining such a community an individual commits to developmental goals – a willingness to "bring others along." Social ties among members reinforce this commitment; the ties lead members to care about others in the community, so that

they put out effort to enlist new members and encourage the growth by existing members. A developmental community may also provide rewards for its members to promote co-members' learning, such as increased social capital or more explicit forms of recognition.

We are building wConnect as a developmental community. The phases in wConnect begin with very low levels of knowledge and commitment, perhaps even in elementary or middle school, and continue throughout members' development through informal and formal education and career activities. However while the wConnect developmental levels map to real world development in CIS, currently the social ties and commitment necessary to promote CIS development for women are dispersed, weak, or not existing at all. Thus we began wConnect with the goal of instantiating and activating a social network that could be energized as part of a developmental community.

2.2 Leveraging and Building Social Ties

Our research approach draws on the emergence and popularity of social networking as a pervasive activity. For example, social networking sites (SNSs) like MySpace, Facebook, and LinkedIn have attracted millions of users in a variety of social groups, including high school teenagers, college students and young professionals. These systems create and reinforce connections among people by making it easy to share content and post and receive reactions to the content (Boyd & Ellison, 2007). These online sites make it easy for users to share profiles, status, social connections and other content, so that they will log in frequently to check for updates related to their own or their friends' content. We hope to harness the energy that many young women already put into building and maintaining their social networks, by redirecting some of this energy toward the developmental activities of wConnect.

Research on SNS behavior suggests that these systems are used primarily to stay in touch with friends (Joinson, 2008; Lampe, Ellison & Steinfield, 2006, 2007); surveys of users indicate that they use these systems more for maintaining existing social relations than for building new connections (Gosling, Gaddis & Vazire, 2007; Lampe, Ellison & Steinfield, 2007). This reinforces our design goal to form wConnect by activating and interconnecting *existing* friendship groups or other social networks, rather than trying to build new ones. A pre-existing tie among women in wConnect is that they are currently part of our college, considering joining us in the future, or have graduated from it recently.

The pervasive use of SNSs and related technologies raises many issues for research, including privacy, management of one's self presentation, and social capital implications. Users create online profiles and share personal information in Facebook not only with friends but also with strangers (Gross & Acquisti, 2005). In general people share significant personal data, apparently trusting in their ability to control what and how the information is shared (Acquisti & Gross, 2006). A qualitative study by Dwyer and colleagues (Dwyer, Hiltz & Passerini, 2007) suggests that users may have generalized trust feelings that affect what they are willing to share – they found that Facebook users express more trust about other members and are more willing than MySpace users to share personal information.

Self-presentation is another research issue for SNSs. In contrast to real world interaction, online behavior tends to rely on selective self-presentation strategies (Boyd & Ellison, 2007; Gosling, Gaddis & Vazire, 2007). People often manage multiple self-presentations for different social groups using the same SNS. However, DiMicco and Millen (2007) noted that users had trouble crafting online identities that meet both professional and personal goals. They suggested that multiple user profiles and access controls may help users to manage their

multiple online identities. Our current community system assumes that members want to separate their identity in their everyday life (e.g., in Facebook) from the identity they use in wConnect activities.

Finally, researchers have discussed possible social capital benefits of social networking activities. An individual's social capital lets him or her draw on resources provided by other members of a group (e.g., information, personal relationships, or business affiliations). Putnam (2000) distinguishes between bridging and bonding social capital; the former refers to loose connections between individuals that might be useful for exchanging useful information and perspectives, while the latter exists among individuals in close relationships that include emotional support. Although the general-purpose tie among members in wConnect is rather weak (shared college identity), we also recruit young women in friendship groups, so that there will also be more tightly connected sub-networks. We hope that these stronger initial ties will supply the motivation needed to engage in developmental interactions.

The growing body of research on social computing provides a starting point for creating wConnect. For example, we expect to encounter and address issues related to privacy, self-presentation, and social capital. The concept of connectedness is an interesting thread, suggesting that simple mechanisms for staying in touch may be just as important in building community as explicit activities. The research also points to a preference for pre-existing social ties in online socializing; this increases confidence in our plan to create the developmental learning community by recruiting and linking women's pre-existing social networks.

3. Building the wConnect Community

3.1 Gathering Requirements at Different Developmental Levels

The core members of wConnect are university students – the female students who are currently in our college's baccalaureate program. However even within this context, the women operate at different levels of development with respect to their CIS knowledge and careers. Furthermore we also recruit women on the "edges" of this population: high school students just starting to consider career interests, and university alumnae now working as CIS professionals. As a result, our target users live, work and play in rather different settings – home, high school, university, business. To design an online community system that might serve such a diverse community, we have been exploring the interests and preferences of these three different age groups (high school, undergraduate, alumni).

Our primary method for requirements analysis has been focus groups. Meeting with groups of 3-6 individuals, we have conducted semi-structured interviews to learn about current use of technology, especially social networking, and reactions and suggestions to the idea of an online place for interacting with other women about CIS interests and concerns. We have conducted three sessions with high school students, five with undergraduates, and three with alumni. Note that the nature of the focus groups vary with the age of the participants. For the high school girls, we deliberately recruited students *not* currently interested in CIS. In contrast our undergraduates and alumni are by definition the young women who have developed such interests. We made this distinction because we wanted to sample the developmental levels we hoped to support within the online community.

Because the high school participants had no particular interest in CIS topics, we conducted their sessions in brainstorming mode. After learning about the girls' use of online tools and extra-curricular activities, we demonstrated an online activity and asked them to envision

similar activities that could be of personal interest. We guided them to focus on web applications that access and manipulate data, because we were searching for project concepts that we could use in a series of hands-on high school workshops. Table 2 summarizes the findings from these discussions, illustrating that these girls use a typical set of online tools, and have many personal interests and ideas for online activities.

Current online tools	Instant messaging, MySpace or Facebook, web browsers, email, wikis or blogs
Extra-curricular interests	Volleyball team, TV series, science olympiad, community theatre, marching band and orchestra, theme movie nights
Personal ideas for data-oriented websites	TV DVD inventory; shopping comparisons; theatre props schedule; band marching scripts; science projects

Table 2. Themes extracted from focus groups with high school students.

A concrete result of the high school focus groups was a series of hands-on workshops that were designed and delivered by undergraduate wConnect members for girls in their former high schools. For instance we have used activities that teach high school girls how to use a simple database to create a web-based shopping "notes" base, and a college application inventory. These workshops serve three goals for wConnect – the undergraduate designers and leaders enhance their own understanding and skills in dynamic web development; the high school girls learn that even young people with no programming background can create "real" web applications; and these same girls are invited to join wConnect. The details of workshop development, delivery, and evaluation are reported in a related paper (Rosson, Ioujanina et al., 2009).

Our discussions with female undergraduates and alumni have been more specific, and in particular have been directed at the goal of building an online community system for wConnect. After first learning about their current online social networking patterns, we probed them for ideas about features of online communities that would attract or detract from their own participation. As summarized in Table 3, these sessions generated a rich set of ideas about how to make an online community more attractive and effective for individuals at these two developmental levels, as well as characteristics that we should avoid if possible.

Attractors	Detractors
Undergrad: Networking with other women in the major; email alerts; fresh content; interview advice; contact information; profiles for friends; attractive and easy user interface; can post stuff	*Undergrad:* No regular updates; but also email or newsletters that are too frequent; auto-alerts with no new info; lack of response to posts; no interactivity; hard to use; unwanted external ads
Alumni: Increasing student awareness of firms; describing interesting projects and jobs; make suggestions based on courses enjoyed; helping with targeted resumes and interviews; help with web presence; company recognition for participation; finding a class project match	*Alumni:* One-on-one mentoring requirements; students expect personal influence on internship/job decisions; no interest in projects; lack of separation between personal and professional identities online; virtual footprints that colleagues or others may discover; lack of anonymity

Table 3. Suggestions about online community tools obtained from focus groups.

A major challenge for our continuing design efforts will be to meet the needs of both under-graduates and alumnae. For example, the college women want to see job and internship postings; yet the alumnae worried that such a listing would make them seem personally responsible for recruiting (e.g., handling requests for information, advocating for wConnect applicants). The focus groups also revealed that neither the undergraduates nor the alumni desired 1:1 mentoring relationships. We were surprised with this result, as mentoring is often proposed as a support mechanism for women in CIS (Margolis & Fisher, 2002; Roberts, Kassianidou & Irani, 2002). When we probed further, we found that some participants or their friends had been paired with mentors in the past, and felt "guilty" when these rela-tionships did not develop or become useful.

3.2 Exploring Community Tools for wConnect

In parallel with gathering requirements and developing high school workshops, we have begun to create online support for the wConnect community activities. Our first online site was built using a set of research tools that are designed to support many types of collabora-tive groups. Bridgetools (http://bridgetools.sourceforge.net) is a Java-based suite of tools and development environment for building applications that support both synchronous and asynchronous navigation and editing; the environment supports a mix of web browsers and object-specific editors. We have used Bridgetools for other community-building activities (Rosson et al., 2007) and planned to follow a similar approach for wConnect. Thus initially each young woman who joined wConnect received a Bridgetools account that would let her access and directly edit community content. We constructed a set of "community pages", leaving them deliberately rough and unfinished in the hope of encouraging the young women to take on the responsibility of further development (Figure 1). Every object in Brid-getools has its own set of permissions that are set by the object's creator, so community members were able to generate and compose a flexible mix of private and shared objects.

Fig. 1. Initial community site built using Bridgetools.

Another reason we first explored Bridgetools as a community infrastructure was our aim to help our undergraduate members develop and deliver hands-on web development workshops to girls at their former high schools. The Bridgetools environment already offers interactive editors for creating and querying databases, including a mechanism for embedding query objects into web pages, rendered via a variety of format options. Thus we were able to develop activities and get them up and running with relatively little software development. The screenshot in Figure 2 illustrates one version of a high school activity using Bridgetools. In this activity, the high school girls (juniors and seniors) are introduced to the challenge of finding, collating, and comparing information about the universities that they are currently considering. Each girl creates a personal database, with each university represented as one record with fields containing school characteristics (e.g., cost, location). Later on, they learn to specify database queries, and display the query results in a web page. With appropriate scaffolding, the girls are able to complete such activities in less than one hour, including time for demonstrating use of the tools, and completing a brief feedback survey at the end of the workshop. We have conducted nine of these workshops in quite varied settings, with girls ranging in age from 13-18, and group sizes ranging from 10-25. In general reactions have been positive, in the sense that most girls are able to do the activity and consider it to be challenging and fun. More details can be found in (Rosson, Ioujanina et al., 2009).
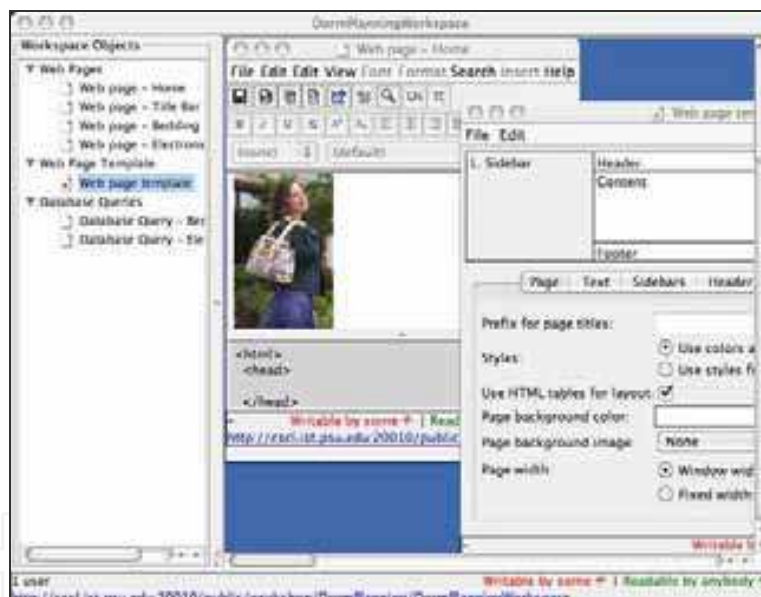

Fig. 2. Bridgetools workspace and tools for constructing dynamic web applications.

With respect to Bridgetools as a development platform, we have found that the high school workshops are well supported by these tools. However we were unable to initiate community building activities using these same tools, primarily because this Java-based synchronous environment is so different from the online tools that wConnect members use in their everyday lives. To use the Bridgetools, the community members must remember and apply a special user account and password; once there, the user interface is quite different from what most college students have experienced in other online activities. These issues, along with our members' general familiarity and positive feelings about the Facebook social networking site led us to shift our focus to Facebook as an online place for wConnect. We had also discovered in our high school focus groups that the participants were often already

using Facebook and saw it as a "cool" place to spend time online; the undergraduates already were using it extensively for their own social networking, so it was a small step for them to expand this aspect of their online lives to include wConnect.

4. The wConnect Application in Facebook

It was our undergraduates research assistants who suggested that we begin by instantiating wConnect as a Facebook group. Facebook allows "closed" groups, so although any Facebook user might stumble across the group, he or she would not be able to join without permission from wConnect group administrators. We would also be able to use the built-in Facebook features to support community exchange, for example a group wall for posting comments, discussion boards, sending event invitations, and so on.

However, while the entire research team was generally enthusiastic about moving our online focus to Facebook, we noted several concerns. First, we lost control over the system's functionality and user interface. Second, we had low confidence in the privacy of data created as part of a Facebook group. Another serious concern was the risk of making our online community inaccessible to prospective members who did *not* use Facebook. We soon found that this was a particular issue for alumnae; some alumnae focus group participants told us that their companies preferred to have them avoid use of Facebook for professional networking. Nonetheless we decided to take this initial step while still recognizing that we would need alternate online community places for non-Facebook users.
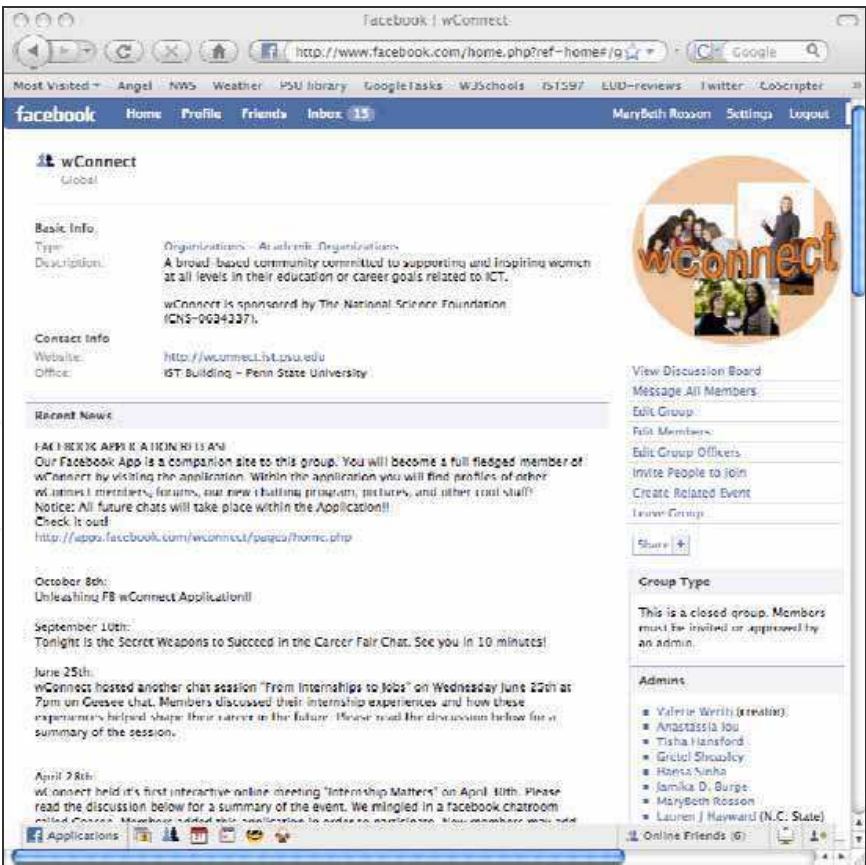

Fig. 3. wConnect closed group created using standard Facebook group functions.

Figure 3 contains a screenshot of the wConnect Facebook group. Like other groups in this SNS, this first instance of wConnect is quite simple: it presents our logo, our developmental vision, a few announcements, and a list of members (with profiles inherited from Facebook). The undergraduates also discovered a Facebook chat application that the group could use for online chats.

Our wConnect group on Facebook has been effective in reaching out to prospective members and building a core. It is easy to advertise the group using emails with a link back to the group; if the person receiving the email is already a Facebook member, all she needs to do is follow the link and request membership in the group. Several community members monitor these requests; they often know the name of the requestor and approve her request right away. On rare occasions we receive requests from people not in our target audience (e.g., random Facebook users "collecting" group affiliations) and the administrators simply re-emphasize the goal of the group and why it is closed to outside members.

By offering prospective members a simple way to express their interest in wConnect, the Facebook group achieved an important design goal: it made the act of community affiliation a simple extension of everyday social networking. At the same time it introduced the limitations we had anticipated: the semantics of a Facebook group are quite shallow; groups are simply a collection of individuals, with the same features and privileges. As a result, we could not extend the group with richer activities grounded in members' developmental roles and commitments; a member's wConnect identity is identical to her Facebook identity. Finally, because this is a research project, we wished to gather data about community activities, and this is difficult to do within Facebook. We needed a mechanism for authenticating members as research participants and for building an archive of wConnect identities and behaviors. Fortunately, Facebook provides a public API that enabled us to build our own application as an extension of normal Facebook functionality.

a) Welcome page   b) Member profiles organized by developmental levels

Fig. 4. Welcome (a) and profile page (b) in wConnect application in Facebook

The new application was deliberately designed to "look and feel" like Facebook, but also to emphasize its role as a distinct online place. The left screenshot in Figure 4 shows the home

page. The visual design leverages the Facebook visual grid for organizing page elements, with tabs for component headings, so that it is experienced as "just one more application" that someone can add to their Facebook profile. The welcome page includes a preview of the community members, just as a standard Facebook home page includes a selection of a few people in the user's Friends list, with a link to the full set. The logo and graphical theme are visually subdued but unique (a logo and a pattern of colored squares); the intent was to make the application seem familiar and comfortable for Facebook users, but at the same time clearly outside of the scope of the parent system. The homepage includes a full version of the header, and secondary pages present a reduced version (e.g., as in the profile page). Prior to building the Facebook application, we had already created a database of wConnect members. The archive tracked participant names, research IDs, level, and contact information for women we interacted with in any activity (focus groups, surveys, email, high school workshops). We also tracked their "research status", namely whether they had signed a consent form and taken the background survey we asked all new members to complete. By accessing this information in our Facebook application, we were able to guide new members through a registration process that ensured that they had given us informed consent as a research participant (meaning we would be able to collect and analyze their interactions within the community) as well as to complete the background survey that was part of our overall project evaluation plan.

However while this database was useful as a comprehensive list of research participants, we needed a richer database for the online application. We wanted to gather and store member-specific information for use by the application, and to grow it as the activities of the community evolved. Initially we conceived of this problem as a member profile database holding personal descriptions that members posted to share with other wConnect members. In other words, we wanted to encourage different online identities within the privacy of this community (DiMicco & Millen, 2007). We pre-initialized this database with information from Facebook when we could (e.g., grabbing their photo, web pages, etc.). As can be seen in the screenshot on the right in Figure 4, a key design feature was developmental distinctions between high school, undergraduate, graduate student, or professional members. These were created using a profile editor that first asks a new member to indicate their level, then fills level-specific template with fields appropriate to each level. For instance, undergraduates describe college majors, while professionals describe current professional activities. Through this simple mechanism we hope to promote the emergence of developmental identities, roles and activities as the community expands.

The wConnect Facebook application was launched about nine months ago, but we have already seen that it relies too much on the Facebook API. For example, a few members have recently begun to *reduce* their Facebook presence (these are more advanced students who are grooming themselves for a career transition). A side effect is that they now are displayed with "absent" images in their wConnect profiles. This is not because they are trying to become invisible within wConnect, but rather because we have provided no alternate mechanism for introducing replacement images. We are now building a mechanism that links to images from Facebook when available, but also allows members to upload images that they are willing to share as part of their wConnect community identities. In parallel we have intensified our development of an alternate site for wConnect, so that members can participate independently of Facebook when and as desired.

5. Growing the wConnect Community

Now that we have developed mechanisms for reaching out to different developmental levels, and built an initial place for online interaction among community members, our focus is shifting to the activities of the community itself. We have learned informally that the wConnect application is familiar and welcoming (at least to those familiar with Facebook); now we need to make it a place that members want to visit regularly and spend time in. One activity that wConnect hosts is "online meetings". To this point, we have restricted these to text chat, primarily because we know that many members do not have the built-in multimedia support that would enable audio or video content as part of an exchange. Our strategy is to encourage one or more members to host a meeting – this involve selection of a topic, initial preparation in terms of issues or questions to raise for discussion, meeting scheduling and invitations (e.g., via Facebook Events), and facilitation during the actual online meeting. We later post a summary of the meeting in the wConnect "chatBoard", an adaptation of a discussion board that we use to archive the meeting minutes (Figure 5).

Fig. 5. Chatboard used to archive and share minutes from online meetings.

Although we use a freeware chat application (Meebo), we embed the link to this chat space within the wConnect application, so as to increase the sense of privacy. Unfortunately these chat spaces are discoverable by others, and we have had a couple of "drop in" visitors; our response has been to explain that we are a closed group and politely ask him or her to leave. Another outreach mechanism that we have integrated within the community is a newsletter that summarizes recent community activities and upcoming plans, as well as featuring one or more individual members or role models in the profession. These newsletters are sent out via email to all community members (including those who have not yet registered for the wConnect application in Facebook), partly as a way to keep the community engaged with

things that are happening, and partly to encourage them to visit the online community system for more information and interaction. In support of community-wide communications such as this we have built into the system a custom version of a listserv: members can use the "Send Group Email" link to select the categories of members (e.g., all undergraduates) and send out a communication to just that sub-group, or the entire database of members. Like the chats, the newsletters are archived as part of the community system (Figure 6).

Fig. 6. Archive of a wConnect newsletter originally sent out by email.

As suggested by undergraduates in our focus groups, we have also initiated an internship forum: any member can post an internship description, and members are invited to comment if they know something about a company or location. To eliminate the feeling of personal responsibility for opportunities that an alumna may post, the template makes it very clear that the posting should tell interested students who to contact for more information. Other community-building activities include a photo gallery and a discussion forum. The photos have been particularly well received, because they include pictures of wConnect members conducting high school workshops that are another aspect of the group, advertising this as an enjoyable and rewarding developmental activity (Rosson et al., 2008; Rosson, Carroll et al., 2009). We are also exploring ideas for activities aimed at building social ties, from informal interactions like sharing trips or favorite movies, to network visualizations that can uncover shared interests or experiences within the community.

6. wConnect Status and Ongoing Work

We have used a variety of methods to recruit members from varying developmental levels to wConnect, and have had some success with each. Some of the methods rely on advertising or broadcasting information, whereas others engage prospective members in a more direct activity. Thus far our efforts include:

- A survey distributed broadly to college undergraduates, with option to indicate interest
- In-person invitations at club meetings for female undergraduates
- Email and slides posted in classes, timed to be just before one of our online meetings
- Focus group invitations emailed to female alumni through contacts maintained by the college development office, timed to occur with recruiting events
- Workshops delivered by college members to students at their former high schools, or through other university outreach programs
- Personal invitations by members to other women who they know and think might be interested.

Through these mechanisms we have contacted more than 150 females across developmental levels. Some have explicitly joined the community (for us this is signified by completing an informed consent and a background survey); others have simply expressed interest in doing so at some point but have not yet followed through with explicit actions. As hoped, the community is diverse with respect to developmental levels. For example, as of Fall 2008, 50 women had registered for the wConnect Facebook application. Of these, 12 were high school students, 27were undergraduates, 4 graduate students, 5 alumnae and 2 faculty.

Our most active efforts to recruit women have focused on high school and college students, but we are now beginning to reach out on alumnae. For example, we have names of 34 alumni who have shared a general interest in our project but who we have not yet recruited into the online community. We have ongoing events at our college that will help us to contact even more individuals and are exploring ways to offer them a more active community role (e.g., serving as a "keynote" in an online meeting with advanced undergraduates). We have yet not issued a general invitation to the female graduate students or faculty in our own college, because we expect that these individuals will be much easier to engage and we want to first establish a core community of active undergraduate members.

Now that we have created a basic infrastructure for online interaction, we are designing activities that might help to engage different segments of the community, and in particular looking for ways to support and reinforce activities that involve interactions *across* developmental levels. An early example has been a series of chats we have held on internship experiences and on making the most of a career fair. In each of these a more experienced member has served as a source of tips and advice for the undergraduate members who participate by asking questions. We are currently investigating topics for other chat sessions that might attract high school members who are seeking advice or other support from college students. More generally we will investigate similar plans for the asynchronous interaction that is possible through the built-in discussion forums.

We are also considering other sorts of online activities. For example, a primary outreach activity for wConnect members is the workshops that undergraduate women plan and hold for high school girls. However at this point these high school workshops and the online community are supported by separate elements of the project. The workshops rely on the suite of tools available through Bridgetools, while the community activities take place in the

Facebook application. Thus a current direction is techniques that might enable us to plan and conduct similar hands-on software development workshops "within" wConnect. For example, in these new workshops, the high school girls might use tools we are building to access and "program" Facebook data.

The focus groups have also generated ideas about online activities that would be attractive to members at different developmental levels. For instance the college students said that email alerts (when interesting things are happening) would be useful; we already have a prototype of a "messaging" mechanism that members can use to invite friends to join the community. We plan to extend this to support a range of messaging and to develop support for a modest amount of automatic alerts. The alumni raised the idea of matching their comments or project descriptions to the undergraduates' interests, and we are exploring ways to process profile information as a starting point for this.

Finally, we are working on ways to reach out to members who do not use Facebook. Currently, we rely on a Facebook-embedded dialog to initialize and authenticate members in the community application. However we are building an independent web-based authentication scheme that can substitute for this, as well as an entirely independent community site. This will allow us to advertise the application more broadly, for example among female alumnae, who will use a more general web application to go through the consenting process and initialize their entry in the member profile database. For the time being, we will continue to maintain both Facebook and non-Facebook platforms, but expect that there will be a gradual move to the independent platform as we develop more novel activities that are not possible (or convenient) in the Facebook setting.

7. Discussion: Prospects for Building Developmental Community Systems

The crisis created by the disproportion of women in CIS is not a concern for the future, it is here now. Many solutions have been proposed and in this paper we have proposed a new approach – a developmental learning community. We have described our vision and the steps we have taken to achieve this vision in wConnect. While the community is clearly still a work in progress, we offer our experiences analyzing the community requirements, the evolution of a community system, and the resulting wConnect system characteristics and developmental activities for consideration and adaptation by other organizations.

One important lesson from our work concerns techniques for initiating developmental learning communities. It is not enough to identify individuals who share your belief in the community's vision. If you expect to engage and energize people who are already busy and occupied with everyday activities, you need to find a way to insert the community's activities *into* these everyday activities. The Facebook group – and more recently the Facebook-based application – provided a simple mechanism for doing this.

Our community centers on its mid-level developmental phases – female college students pursuing CIS education and careers. But we recognize that mid-level members may not have sufficient expertise or perspective to organize and implement developmental activities on their own. It has been important for us as researchers to help in brainstorming and organizing these early community-building activities (e.g., chats in which professionals take questions from students, workshops in which undergraduates provide hands-on programming experiences to high school students). Now that several example activities have been implemented and documented, the members have models that they can use for their own

planning. A critical question will be the *sustainability* of the overall project – what will core community members do once the external stimulus of the research project is over? Will they simply continue to enact the activities we have already established (e.g., the invited chats, the high school workshops)? Or will they continue to generate and pursue new ideas?

Note that the evolutionary process could have been quite different if wConnect had been centered on the expert women who are CIS professionals (the alumnae). But if we had done that, we would have likely encountered constraints from the companies these professionals work for, and we would have decreased our emphasis on the important developmental connection from college to high school. For logistic reasons, it is also much more difficult to locate and to establish and maintain connections with the alumnae, who by definition have moved on to the critical early phases of their personal career trajectories. An interesting question that we have not yet been able to pursue is whether and how a community like wConnect can support these young professional women who are distributed across many different industries and who are fulfilling may different job responsibilities. As we move on to engage more of our alumnae (and especially as our current undergraduate members matriculate and change roles), we hope to investigate this question more directly.

Thus far we have not emphasized the social ties "beneath" the wConnect community, even though the logic of developmental communities gives them a critical role. We know that many of the young women who join the community already know one another; in fact we rely on this as a recruiting mechanism. Thus far we have not tried to analyze these linkages, at least in part because it seems a more personal aspect of these young women's lives. However as we move forward, we plan to explore ways to highlight implicit social networks so that we might more strongly inter-connect community members who share different sorts of interests. For instance current members have no way of becoming aware of their everyday similarities (e.g., sharing an interest in music). But they are already expressing interest in learning more about unfamiliar members, for example where they have lived, and what they do for relaxation. We will keep developmental goals in the foreground, but also enable informal social exchange that might enliven or reinforce those goals.

We have been surprised at the paucity of work investigating the role of community in addressing under-representation of women and minorities in CIS. The longtime success of the Systers email list is good evidence that women in CIS enjoy and may benefit from peer interaction (http://anitaborg.org/initiatives/systers/). Yet most outreach efforts are institutional programs, for instance, summer camps or workshops, or perhaps course topic modifications aimed at attracting a more diverse population of young people to CIS careers. The premise of wConnect is that these efforts can and should be complemented by work aimed at creating and nurturing developmental learning communities.

8. Conclusions

This chapter has presented a snapshot of our work in initiating and supporting an online developmental community for women interested in CIS education and careers. Clearly we are far from a summative view of whether and how well our community-building techniques will succeed. By design wConnect will form and grow according to the interests and energies of its members. This makes its difficult to predict its trajectory. As participatory action researchers, our job is to ensure that the activities and tools we provide are engaging, useful and usable; but we must let the members discover their own developmental paths.

Acknowledgements

9. References

Acquisti, A. & Gross, R. (2006). Imagined communities: Awareness, information sharing, and privacy on the Facebook. Proceedings of 6th Workshop on Privacy Enhancing Technologies, pp. 36-58, Cambridge, U.K.

American Association of University Women Educational Foundation, Commission on Technology, Gender, and Teacher Education. (2000). Tech-Savvy: Educating Girls in the New Computer Age. Washington, D.C., AAUW.

Blum, L. (2001). Women in Computer Science: The Carnegie Mellon Experience. White paper prepared as a report to Carnegie Mellon University President Jared Cohen.

Boyd, D.M. & Ellison, N.B. (2007). Social network sites: Definition, history, scholarship. Journal of Computer-Mediated Communication, 13 (1), Article 11, available online at http://jcmc.indiana.edu/vol13/issue1/boyd/ellison.html

Boyd, D.M. (2006). Identity Production in a Networked Culture: Why Youth Heart MySpace. American Association for the Advancement of Science, St. Louis, MO.

Brown, A.L. (1987). Metacognition and other mechanisms. In Weinart, F. E., and Kluwe, R. H., (eds.), Metacognition, Motivation, and Understanding. Hillsdale, NJ, Erlbaum

Brown, A.L., & Campione, J.C. (1996). Psychological theory and the design of innovative learning environments: On procedures, principles, and systems. In Schauble, L., and Glaser, R. (eds.) Innovations in Learning: New Environments for Education, pp. 289-325, Mahwah, NJ, Erlbaum

DiMicco, J.M. & Millen, D.R. (2007). Identity management: Multiple presentations of self in Facebook, Proceedings of the ACM Group Conference 2007, pp. 383-386, New York, NY, ACM Press

Dwyer, C.; Hiltz, S.R. & Passerini, K. (2007). Trust and privacy concern within social networking sites: A comparison of Facebook and MySpace, Proceedings of the 13th Americas Conference on Information Systems, Keystone, CO, 9-12 August 2007.

Edwards, L.D.; Coddington, A., & Caterina, D.(1997). Girls teach themselves, and boys too: Peer learning in a computer-based design and construction activity. Computers in Education, 29(1), 33-48.

Ellison, N.B.; Steinfield, C. & Lampe, C. (2007). The benefits of Facebook "friends:" Social capital and college students' use of online social network sites. Journal of Computer Mediated Communication, 12(4),1143–1168.

Gosling, S.; Gaddis, S. & Vazire, S. (2007). Personality impressions based on Facebook profiles. In Proceedings of the International Conference on Weblogs and Social Media.

Graham, S. (2004). Waterloo offers CS seminar for high school girls. Computing Research News, 16(10, 2-5.

Gross, R. & Acquisti, A. (2005). Information revelation and privacy in online social networks (The Facebook case). In Proceedings of the ACM Workshop on Privacy in the Electronic Society (WPES '05).

Joinson, A.N. (2008). Looking at, Looking up or Keeping up with People?: Motives and Uses of Facebook. In Proceedings of CHI '08, pp. 1027-1036, New York, NY, ACM.

Lampe, C.; Ellison, N. & Steinfield, C. (2006). A face(book) in the crowd: social searching vs. social browsing. In Proceedings of CSCW 2006, pp.167-170, New York, NY, ACM.

Lampe, C.; Ellison, N. & Steinfield, C. (2007). Changes in use and perception of Facebook. In Proceedings of CSCW 2007, pp. 721-730, New York, NY, ACM.

Leonard, E.B. (2003). Women, Technology, and the Myth of Progress. New York, NY, Prentice Hall.

Margolis, J. & Fisher, A. (2002). Unlocking the Clubhouse: Women in Computing. Cambridge, MA, MIT Press.

McDowell, C.; Werner, L., Bullock, H., & Fernald, J. (2003). The impact of pair programming on student performance, perception, and persistence. Proceedings of ICSE 200, pp. 602 – 607, New York, NY, ACM Press.

Putnam, R. D. (2000). Bowling Alone. New York, N, Simon & Schuster.

Roberts, E.S.; Kassianidou, M. & Irani, L. (2002). Encouraging women in computer science. SIGCSE Bulletin, 34(2), 84-88.

Rosson, M.B. & Carroll, J.M. (2006). Developmental learning communities. Community Informatics, 2(2).

Rosson, M.B.; Carroll, J.M., Zhao, D. & Paone, T. (2009). wConnect: A Facebook-based developmental learning community to support women in information technology. Proceedings of Communities & Technology 2009, State College, PA, 25-26 June, 2009.

Rosson, M.B.; Dunlap, D., Isenhour, P.L., & Carroll, J.M. (2007). Teacher Bridge: Building a community of teacher developers. Proceedings HICSS 2007 (Abstracts p. 5a). New York, NY, IEEE Computer Society Digital Library.

Rosson, M.B.; Ioujanina, A., Paone, T., Sheasley, G., Sinha, H., Ganoe, C., Carroll, J.M. & Mahar, J. (2009). A scaffolded introduction to dynamic website development for female high school students. In Proceedings of SIGCSE 2009 (March 2009, Chattanooga, TN).

Rosson, M.B., Sinha, H., Zhao, D., Carroll, J.M., Ganoe, G. & Mahar, J. (2008). Cultivating a landscape of online places for a developmental learning community. In Proceedings ICALT 2008 (pp. 311-315). IEEE.
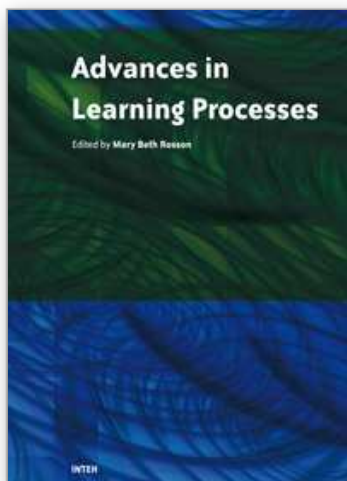
Advances in Learning Processes
Edited by Mary Beth Rosson

Readers will find several papers that address high-level issues in the use of technology in education, for example architecture and design frameworks for building online education materials or tools. Several other chapters report novel approaches to intelligent tutors or adaptive systems in educational settings. A number of chapters consider many roles for social computing in education, from simple computer-mediated communication support to more extensive community-building frameworks and tools. Finally, several chapters report state-of-the-art results in tools that can be used to assist educators in critical tasks such as content presentation and grading.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Mary Beth Rosson, John M. Carroll, Dejin Zhao and Hansa Sinha (2010). wConnect: A Developmental Community for Women in Computer and Information Science, Advances in Learning Processes, Mary Beth Rosson (Ed.), ISBN: 978-953-7619-56-5, InTech, Available from: http://www.intechopen.com/books/advances-in-learning-processes/wconnect-a-developmental-community-for-women-in-computer-and-information-science

INTECH
open science | open minds