

# Fostering an informal learning community of computer technologies at school

LU XIAO\* and JOHN M. CARROLL

Center for Human–Computer Interaction, College of Information Sciences and Technology,  
Pennsylvania State University, University Park, PA 16802, USA

Computer technologies develop at a challenging fast pace. Formal education should not only teach students basic computer skills to meet current computer needs, but also foster student development of informal learning ability for a lifelong learning process. On the other hand, students growing up in the digital world are often more skilled with computer technologies than their teachers. We describe an online course design project in which a group of students designed an online health course for their middle school, and teachers played the roles of facilitators and learners. We suggest fostering an informal learning community of computer technologies at school as a supplemental method of formal computer education to address the shift in educational context and as a place offering opportunities for students to work on real-life projects and solve real-life problems.

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## 1. Introduction

Technological concepts and skills are essential in today's world. Computer education is increasingly important at school. In order to keep up with the fast development of the digital world, one needs to master the skill of learning new technologies. Formal education should not only teach students basic computer skills to meet the current needs, but also help students to develop informal learning abilities for a lifelong learning process.

On the other hand, computer education has been a challenge for schoolteachers. Traditional classroom-based learning generally adopts the 'adult-run' learning model in which teachers possess more knowledge about the subject and transmit knowledge to students (Rogoff *et al.* 1996). However, it is well known that students who grow up in the digital world are often more technologically 'savvy' than their teachers. In some subjects or areas, teachers may not be able to function in their traditionally accepted role as content experts. Moreover, many schools focus on

providing the physical infrastructure such as computer laboratories and Internet access, and have overlooked the need to provide the appropriate programme to help the schoolteachers to effectively incorporate information technology into their teaching. For example, in a national survey of teachers, Market Data Retrieval (1999) reported that 60% claimed 5 hours or less of training annually.

One approach to alleviating the situation is to cede more control to students. In such a learning environment, students interpret and demonstrate their understanding and receive assistance from those who are more advanced in the subject (Hertz-Lazarowitz and Miller 1992, Brown and Campione 1996). Through the process of articulating, illustrating, and debating, students learn from expressing and negotiating differing views about how to solve a problem or resolve an issue (Chan *et al.* 1997). The Study Circle, which was developed in Sweden in the late nineteenth century, is the idea of people studying in a small group, where the group leader is an organizer who does not possess theoretical qualifications, and the

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\*Corresponding author. Email: lxiao@ist.psu.edu

group/circle members have no previous theoretical qualifications but practical experience (Brattset 1982). Terms applied in the Study Circle are *circle members* or *participants* instead of *pupils* and *students*, and *circle leaders* instead of *teachers* (Bjerkaker 2003). The Study Circle is proof of the concept that students learn from each other and gain knowledge without teacher supervision.

Another supportive but complementary solution is to exploit community resources better. The local community presents a real-life context with which students are familiar to which they can apply computer skills. Constructivists believe that students learn best when they engage in real activities (Dewey 1916). Engaging in real-life activities helps students realize that their learning is meaningful and they learn how to apply their knowledge about the real world to the activities. School is a learning-centred institution which aims to help students learn how to make lives (*not* how to make a living) (Postman 1995). School is an important place for connecting community resources with students' educational needs. Moreover, often students are often interested in learning and using new technologies because it is fun to them (computer games are good examples). Working on real-life problems helps educate them in how to apply technologies to serve society better.

Our research group, Civic Nexus, has worked in collaboration with a local high school programme that confronted this issue. In working with the programme, we observed how a group of students collaborated with teachers on a technology project in their school. In the process, both students and teachers acquired knowledge of online technology, but their responsibilities were recast: the teacher played an important role as facilitator in this learning process; however the students were more knowledgeable about the technology than the teachers and became the experts, taking the roles of instructors and consultants (Xiao *et al.* 2005).

Based on the experience of working with the local high school programme, we suggest fostering an informal learning community of computer technologies in schools as a supplemental method of formal computer education and a means of helping teachers to integrate technology into the school curriculum. We begin with an introduction to Civic Nexus research, followed by an in-depth description of the technology project—designing an online health course for school. We then discuss some design implications of creating a website for the informal learning community. We conclude with a discussion of the evaluation of the community.

## 2. Civic Nexus: encourage informal learning of computer technologies in community groups

Civic Nexus is a 3-year community-oriented participatory design project which aims to helping community groups to

sustain technology learning and development in their organizations. Building on previous methodology that blends ethnographic methods with long-term participatory design (Carroll *et al.* 2000), Civic Nexus researchers work with community groups to investigate the existing infrastructure of technology support in community groups as well as helping them to develop their technology capacity through various strategies, such as enriching community activities through technology implementation, developing and maintaining community websites, and developing strategies to manage technical expertise in their organization (Merkel *et al.* 2004). We also collaborate with community groups on technology projects to foster informal learning of technologies in the community. In terms of promoting sustainability, we see community groups as owners of technology projects. We believe that supporting informal learning in community groups is crucial to helping them meet the technology needs and sustain technology adoption in the organizations.

### 2.1 Informal learning in community groups

Technology implementation is a challenge for small community groups with scarce resources (Suchman 1996, McPhail *et al.* 1998, Mogensen and Shapiro 1998). There are often few full-time staff members in these groups and they are usually already overwhelmed by their workload. Limited (or no) financial resources mean that it is unlikely for community groups to be able to afford formal training courses for members. Non-technical volunteers usually dedicate a long-term effort to community services and civic engagement, but technology volunteers who help with community technology issues often come and go.

The context of small community groups makes it particularly important to offer informal learning support in the community groups. Informal learning takes place in a wide range of settings, including both the non-education-centred locations like clubs and shopping centres, and education-centred environments such as public libraries and schools (King 1974). 'Informal learning can be unpremeditated, self-directed, intentional and planned' (McGivney 1999, p. 1). Informal learning occurs continuously throughout life, requiring no particular preparation (Candy 2002).

Informal learning is explicit learning that is not constrained or supported by prescribed frameworks (Eraut *et al.* 1998). In our fieldwork, we have observed that people do learn technologies informally. For example, we have observed that members of a watershed group formed a learning and design group in order to develop a community website, a programme administrator of a historical society asked us to draw a diagram for the process of uploading a file to a web server, and an executive director of a leadership group asked the technician who was fixing a

computer crash problem to explain what the technical term FAT (file allocation table) means.

In Civic Nexus research we adopt the following definition of informal learning (McGivney 1999, pp. 1–2): informal learning is the learning that (a) occurs outside a dedicated learning environment and may not be recognized as learning (e.g. listening, observing, interacting with others), and (b) involves non-course-based but intentional learning activities, which take place when there are explicit interests and needs from community members. According to this definition, we consider students' learning processes throughout the project as informal, although the project was carried out in the context of school.

### 3. Work with a school programme: towards an informal learning community

At the beginning of the Civic Nexus research, we held a workshop in which we invited potential community organizations, including the Learning Enrichment Center/Gifted Support Program (LEC), a programme associated with the State College Area School District (SCASD) (<http://www.scasd.org/249710010249155/site/default.asp>), to partner us on the project. LEC was planning on an online course design project and expressed their interest in collaborating with us. We worked with the student group and an LEC teacher on the project for approximately 15 months starting in October 2003. After that, we continued to monitor the activities of the group through their mailing list.

#### 3.1 Background of the online course design project

Unlike other community groups that are civic-goal oriented, LEC is dedicated to supporting informal learning by students. The programme provides learning opportunities to students who are interested in exploring areas beyond the standard curriculum. It supports the development of a range of interests such as art, writing, and mathematics through various activities, such as field trips, guest speakers, and training sessions. It also encourages students to develop problem-solving and research skills through participation in real-world projects.

Our work with LEC is about understanding the process of one of their technology projects—putting a health course online. As online courses become increasingly popular, the high school and LEC decided to push their teaching practice beyond the current classroom-based and correspondence models towards online education. Currently, the students may take the health course either in a traditional classroom setting or as what the school refers to as a 'correspondence course', i.e. self-study based on course materials handed out by the teacher with a final examination at the end of the semester. It has been noticed that

there is an increasing number of students take the health course via correspondence (over 100 every year). LEC believes that because the correspondence model offers more flexibility and the course content itself can easily be self-taught, students prefer correspondence to classroom learning for the health course. LEC decided to select the health course as the first one in their online course design project, assuming that the online model could attract the students because of its even greater flexibility than the correspondence model, which it may eventually replace.

An LEC teacher advertised the project and recruited 10 teenage students who were interested in learning web technologies when the project first started in October 2003. The level of each student's computer skills ranged from very basic technical skills, such as scanning, to more advanced skills, such as programming in C++ and writing shell scripts for servers. A high school senior joined the group in January 2004 and became the administrator of the course website. The LEC teacher was comfortable with basic computer technologies like email or web surfing, but did not have experience of online course development.

We initially acted as consultants, providing advice about website design, such as commenting on the website layout, suggesting course management software, and hosting a laboratory session at our university. Our role gradually became more passive as students were able to take more control of the design process, and we acted as an occasional 'hint giver' or 'active listener' who encouraged reflection on the project. We also took a passive role as meeting observers and email lurkers, in line with our research belief that community groups should offer support for informal learning.

#### 3.2 Methods

**3.2.1 Data generation.** We conducted face-to-face open-ended interviews (some of the interview questions were asked via email) and we observed the process through participant observation. We interviewed the SCASD director once and the LEC teacher five times. The interviews covered a broad range of topics related to the project such as the background of the LEC, the goals of this project, and issues related to the design process. At the end of the project, we interviewed the teacher about her learning experience with technology during the project and her feedback on working with this student group.

Since our interest is the process of the project, participant observation was our major data-generation technique (Mason 2002). We participated in the weekly design meetings in which students discussed and worked on the design of the online course and joined the group's mailing list. We also videotaped the presentation that the student group gave to the schoolteachers and school administrative about the course website they had developed.

We also collected secondary data. For example, we collected the design meeting minutes, design artefacts, and the final version of the website. Finally, we produced a questionnaire to capture the students' learning experience during the process.

**3.2.2 Data analysis.** We analysed the data using the general analytic strategy of developing a case description (Yin 2003). The descriptive approach helped us identify the complex stages of designing a website through group effort. In this project, a group of students gathered to design the online course under the facilitation of an LEC teacher. We view it as a collaborative learning process in our analysis, reflecting important factors that impact on the learning outcome.

**3.2.3 Data evaluation.** Rigour is a challenge for qualitative research. Dubé and Paré (2003) investigated the level of methodological rigour in positivist interactive systems case research conducted over the past decade. In Civic Nexus research, the multiple sources of data collection provide evidence of data triangulation. We (as Civic Nexus researchers) met biweekly with the rest of the research group to report fieldwork, including interviews and observations, and reflect on the collected data for a better understanding of the process. The group process in data analysis ensures the intercoding reliability. As a way of member checking, we sent the LEC teacher our interpretation of the project process, accounting for our bias in the interpretation.

### 3.3 Design process of the online health course

Picture this: teachers are sitting in a computer laboratory, listening attentively as the students explain, using a PowerPoint presentation, how to use a course management system and then quiz the teachers on their retention of the material at the end of the lesson.

This is what happened in the project of designing the online health course in which an LEC teacher played an important role as facilitator and the students took the roles of instructors and consultants who are more knowledgeable on technology contents than the teacher. During the project process, the students learned to use the open source courseware Moodle and designed the course website. After the course website was developed, the students gave a PowerPoint presentation to schoolteachers and school administrators, describing the implementation details and pragmatic benefits of the website they built and the design process they followed. At the end of the presentation, students gave the teachers an 'in-class' quiz to examine how much the teachers had learned during the presentation, and answered the teachers' questions and concerns about offering online courses at school.

Later, the students took part in designing an evaluation of the online health course developed. Together, the LEC teacher and the students constructed a questionnaire for students who would take the course to evaluate its format of the course, including input on both the teacher's course evaluation expertise and the students' knowledge of evaluating technologies. The questionnaire covered a wide range of issues, such as the helpfulness of online forums and online chapter quizzes in learning about health issues, comparison of the online course with the correspondence course, the benefits and disadvantages of taking online courses, and user interface design issues such as ease of website navigation and problems with the course website (e.g. technology difficulties). Throughout the process, students were assigned different tasks by the LEC teacher based on their computer skills and preference. These tasks included scanning materials, uploading files, designing quizzes, and so on. At least two students worked together on each task, and the LEC teacher facilitated and monitored the progress. A detailed description of the project process and the role shifting between the students and the teachers is given elsewhere (Xiao *et al.* 2005).

## 4. Towards an informal learning community of computer technology

Learning communities usually imply places where people share knowledge, cooperate, and work together on learning activities (Baker *et al.* 1996, Bauman 1997, Kowch and Schwier 1997, Rasmussen and Skinner 1997, Cross 1998, Haythornthwaite 1998, Riel 1998, Palloff and Pratt 1999, Raymond 1999, Schwier 1999, Hill and Raven 2000, Misanchuk and Anderson 2001). School is a formal learning community where students are brought together to learn subjects and encouraged to share their experience and knowledge, but 'the learning in question will be much more restricted and externally defined than an informal learning community' (Romiszowski and Mason 2003, p. 408). In an informal learning community, learners are self-selected and gather together for informal learning purposes (Romiszowski and Mason 2003, p. 408).

After completing the design of the online health course, the students continued to learn computer technologies together. The positive learning atmosphere of the project attracted other students to join them (in April 2005, there were 17 students on the mailing list). The students formed an official computer club called TECS under the supervision of the LEC. In the computer club, the students discussed various project ideas including:

- To set up an email server on our TECS server;
- Computer classes for students and teachers;
- Even more personalized teaching one on one tutoring;
- Graphic design, Web page design; Build computers

for people; Computer modification/upgrade; LAN party; Game server Rental' (evidence from email dated 14 October 2004).

TECS is not the first computer club supervised by LEC. A Bell Grant was issued to the programme 10 years ago to support a computer club for students who were interested in exploring computer technologies, and a NERDS group was formed under the grant (all members of the NERDS graduated before the online course design project). However, unlike the NERDS group, TECS computer club is not just a computer club that a group of students form to learn and play with 'cool technologies'. TECS members are interested not only in 'cool technologies', but also in helping school and others in the local community. For example, the list includes ideas like 'Computer classes for students and teachers', 'Build computers for people', and 'Game server rental'.

Based on our experience of working with the LEC, we suggest an informal learning community of computer technologies at school as a complementary method of formal computer education and a way of helping teachers integrate technologies into the school curriculum. The community has four goals as described below.

#### 4.1 Support students to work on real-life projects

Constructivists believe that students learn best when they engage in real activities. Authentic activities motivate students, as the process itself demonstrates that their learning is meaningful and they can apply their knowledge about the real world to the activities.

The project of designing an online health course is an authentic learning activity. The problem itself is a real-life problem. The students were very familiar with the context of the project because it was not just any website design project, but one of designing an online course for their own school! In fact, some of the students in the group who designed the online course had already taken the health course through correspondence and some had experience of taking an online course. These motivated students to be very active from the beginning of the project. For example, in brainstorming sessions, students suggested many functions, based on their experiences, that an online course should have:

Site should include a general picture of how the class is doing, both on-line and traditional; Site should include a timeline and a suggested deadline; Site could include auto-quizzes with optional retakes; Questions for quizzes would come from a bank of a predetermined number and would be chosen randomly; Hints could be an option; Client would receive immediate feedback on quizzes; The site should have several times to chat with the teacher.

The functions suggested by the students demonstrate what they want from an online course (the LEC teacher was mainly a facilitator of the meeting and note-taker of the ideas).

By engaging in this real project, students learned Moodle quickly. The LEC teacher introduced Moodle to the students by email on 2 December 2003. We provided the laboratory session about installing the software on 18 December 2003. After that there was a winter break until early January 2004. The students then went on to learn the courseware and finished putting one section of the course online by February 2004. They gave schoolteachers and school administrators a tutorial-like presentation on how to use Moodle for developing an online course on 15 March 15 2004. They carried out all the project activities after school hours. We believe that this was a successful example of learning a new technology within a short amount of time, especially as the students learned Moodle by themselves starting from various levels of computer skills. The success of this design project at school in an informal learning environment demonstrates that supported authentic learning in an informal learning community is feasible and is an excellent approach to engaging students in informal learning activities.

The goal of the authentic learning model is not just to helping students to learn the content of the subject, but also to help them interpret, process, and apply this knowledge. The example of brainstorming ideas shows that students assembled their prior knowledge of the course itself and the online course format with respect to the design project. An email dated 26 November 2003 shows that the students not only discussed website design issues, but also complex real-life issues related to offering the course at school:

Determine who can take cyber class and establish guidelines for:

- number of students
- limited number ???
- when it will be offered
  - class will be offered Fall, Spring, Summer
  - time frame
  - class will have definite starting and ending dates
- progression
  - on-line class will have a linear progression

Teacher concerns shared by Mr XX [he is the health course teacher and he was in the meeting]:

- who will monitor the class
- how will the traditional class be replicated on-line
- would it be possible to include a project
- can current power point presentations be included

We agreed that Mr. XX should join us when we begin working on the actual construction of the site.

Another email from a student in the group showed the serious thought he gave to this real-life project:

One of the best things about having a computerised class is getting the computer to do some of the teacher's work. I therefore think that after we get all this in, we should set a goal of going back and changing as much as we can into Moodle activities and quizzes. The vocab sections especially are just begging to be graded electronically. Let's try to have a meeting soon when everything is up there, and we can discuss that.

The health course that the students designed not only demonstrates their learning outcome of the technology, but also reflects their understanding of how an online course should be designed. Moreover, the students' presentation illustrated how they articulated their work and interpreted their understanding of the project. The LEC teacher acknowledged that the students learned a great deal in terms of communication and collaboration skills as well technology: '[they] need to communicate to staff and public [to make the project succeed]'. Most of students said that the hardest part of the project was to organize course materials and design the website. For example, one student said that '[the hardest part of the problem in the project was] figuring out the best way to put things into the course [website]'.

Students also gained the experience of coordinating with people that are involved in this real-life project. For example, when the student group was looking for a permanent host for the online course, one of them asked the technology director of the school for help, as shown from an email dated 15 December 2004:

XX had a meeting with XXX who will be setting up the TECS server in the North Building with XX as admin for our cyber site. This will hopefully happen in January.

As shown by the email, the high school freshman XX not only worked as designer in the project, but also as a project representative negotiating with the school administration.

#### 4.2 Encourage peer help with technology learning

It is well known that people learn together and share knowledge in community. For example, Rosson and Carroll (2003) discussed the informal and collaborative learning between young people and senior community members when working together on a computer simulation project. It is typical at school that groups to help advanced students learn more and groups to help students who need learning aids differ substantially. This informal learning

community offers a place that invites students at all levels to join the learning activities. The informal learning community provides a less competitive study environment than a classroom and helps engage students at different levels in collaborative activities. Collaborating with peers at different levels of computer knowledge helps students realize the importance of cooperation, and stimulates students who are more adept at computer skills to help those who are less competent. At the beginning of this project, because all the NERDS group members had graduated and the LEC programme did not have a computer group, the LEC teacher decided to recruit students who were interested in learning technologies. It is this recruitment strategy, which was based on interest and not the level of computer skills, that enabled students who were good at computers and those who were not to be grouped together, and this worked out very well! The LEC teacher commented: 'The students truly amaze me. They are very committed, knowledgeable, and very willing to help each other to troubleshoot problems or teach a new concept'. For example, after a student had learned how to create a unit of quizzes for the online course, he wrote instructions about it for his peer students who needed to work on this task. In order to ensure that his team members would understand the procedure, he wrote down 11 detailed steps (one with seven different subparts) and added the following note at the end of the instruction:

Note: You can also add questions by typing a special .txt file. The details of this format can be found by clicking on the yellow question mark by the 'Import Questions from File' button in the category-editing column.

In an informal conversation with the LEC teacher, she told us that previous NERDS group members were very good at computers but they were only interested in learning advanced technologies. Moreover, 'if you don't speak the same language [about technologies], you don't get much interaction'. Through working with others at different computer levels, the TECS club considered the learning needs of less advanced students. For example, one of the TECS ideas is 'Even more personalized teaching [and] one on one tutoring'.

As well as supporting collaboration of students at different levels of computer skills, supporting intent participation is also important in this informal learning community: 'Intent participation is a powerful form of fostering learning' (Rogoff *et al.* 2003, p. 176). In intent participation, people learn through participating in on-going or anticipated activities, with attentive and intentional watching and listening: 'Learning through observation and listening-in is pervasive in children's lives and is effective' (Rogoff *et al.* 2003, p. 176).

Listening-in includes both eavesdropping and overhearing (Rogoff *et al.* 2003). In the course design project, most of meetings were held in the computer room at LEC. Sometimes there were other students in the room checking emails, browsing the Internet, or working on their homework. In the middle of the project, the LEC teacher introduced a female student who was interested in the project to the group. This student had a friend in the design team, and prior to joining the project she was sometimes in the computer laboratory when the student group met. Although we do not have data to explain why she became interested in the project, we believe that her awareness of the project process and what the project members were doing played an important role.

Students in the group also learn from their group members through intent participation. For example, one student emailed the group for help on a technology issue, claiming that he is willing to learn through intent participation (from an email dated 19 April 2005):

One more thing . . . I am unable to upload files to the 'siteFiles' section, only the 'English 12' section. This isn't much of a problem, except that there is one image that needs to go in a folder in the 'siteFiles' part. Could someone please move the file 'Wolves0001.5.jpg' from the 4th quarter folder of the English 12 section to the '4th Quarter\Of Wolves and Men' folder of the 'siteFiles' section? Either that or **show me how to do it myself**.

'Learning through keen observation and listening, in anticipation of participation, seems to be especially valued and emphasized in communities where children have access to learning from informal community involvement' (Rogoff *et al.* 2003, p. 176). In this informal learning community, students are not only invited to work with others on meaningful activities, but also encouraged to 'observe' the activities.

#### 4.3 Encourage teachers to work with students as teams

McGivney (1999, p. 25) demonstrated that key factors in widening participation and encouraging educational progression are people who inform, advise, and encourage informal learners, and motivate and help them to engage in new activities including formal and certificated programmes. Teachers are the 'key' people in this informal learning community. Students look to teachers who possess advanced knowledge of computer technologies for technology guidance, an understanding of the complex phenomena of the real world, and the social impacts of the technologies, and for knowledge of how to apply technologies to solve real-life problems and enhance real-life quality.

Schoolteachers benefit from working with students. The online course design project illustrated that teachers can facilitate computer technology projects even if they do not know how to implement the technology (Xiao *et al.* 2005). Working together helps teachers learn information technologies from the students who are more knowledgeable about computer application and learn together with students through meaningful activities.

Authentic activities related to school education not only motivate students to participate in the process quickly because they are familiar with the context of the real world, but also helps teachers integrate technologies into the curriculum. This also increases awareness of the informal learning community in other teachers who are not involved in the projects and encourages them to join in the community. For example, in the online course design project, although English teachers were not engaged in the design, they were interested in what the student group was doing and attended the student presentation. After the presentation, English teachers decided to put an English course online and asked TECS students for help.

In contrast with using authentic learning as a formal education method, teachers' role in the informal learning community is no longer a true evaluator of students' behaviour. Teachers are community learners who are more experienced in real-life experience. The students' role is also redefined with respect to their interaction with teachers. They are not only learners, but also consultants helping teachers with technology if needed, and shapers of the community who propose ideas for community activities, carry out technology projects, and recruit new members.

#### 4.4 Create and maintain connections with the school and the local community

The online course design project at LEC is different from a design project for a technology course. A project assigned through a computer course typically involves only the students and the course instructor, and the students usually need to coordinate with the course instructor and/or their project team members only. This design project is different. It happened in the context of the school, not a course. It has involved coordination with other school members such as the health course teacher who provided course materials, the other LEC staff members who helped on hardware support, and other teachers, like English teachers, who attended the presentation and joined the discussion of the course website design.

The LEC teacher told us that she found out that Moodle is a software for developing online courses and that students could use it to design the online health course in an informal conversation with the technology director and a technology service person in the school. In September 2004, the server of the online course went down. The LEC

teacher had to call the service help for Go Daddy, where the domain of the online course was registered (a commercial organization that offers web hosting service).

Finding a permanent host was a major issue. Being unable to receive permission to host the course on the school server, the LEC teacher called Adelphia to check the cost and process for obtaining a static IP from the company in early October 2004, as shown in an email dated 10 November 2004:

Server status – Server is now up and running. Thank you, XXX. We are looking into getting a static IP to keep our server up and running. XXX has called Adelphia and they do provide static IP for this area. She called XXX from computer services and we should hear within a week as to the cost and process.

The school did not decide to host the course website until December 2004, as shown in an email dated 15 December 2004:

XX had a meeting with XXX who will be setting up the TECS server in the North Building with XX as admin for our cyber site. This will hopefully happen in January.

A personal email from the LEC teacher to one of the researchers on 19 December 2004 hints at the difficulty in getting support from the school when trying to find a permanent host:

XXX has approved the static IP and XX will be network admin. It has taken us this long!!!! but we kept on trying.

In both emails, XXX is the technology director of the school. All these examples illustrated that a real-life project can involve social networking with the real world, and the difficulty of coordinating with other people who are not directly engaged in the project.

Social capital is about how people build and maintain active connections in a social entity (e.g. an organization, a community, or a civil society) (Coleman 1998). Rose (1989) defines social capital as the repository of an individual's formal or informal social networks for producing or allocating services. A social network is a set of individuals or groups who are connected to one another through socially meaningful relationships (Wellman and Berkowitz 1988). In order to carry out the project smoothly and successfully, the informal learning community needs to expand its social network by creating and maintaining connections with its broader social context—the school and the local community.

## 5. Design a website for the informal learning community

In a typical virtual learning community, members are usually located at different places and seldom meet each other in real life. Most learning activities in the community are carried out by virtual collaboration using the internet. The informal learning community we discussed in the previous section is different. Its members are from the same school and face-to-face interaction is the major means of carrying out learning activities.

However, the Internet still plays an important role in such an informal learning community. In the design project, although students met once a week to discuss project-related issues and work together, the group still used a mailing list to send out meeting minutes, update information about the project issues, and ask for technical help, as shown in the email examples provided in the previous section (e.g. emails dated 26 November 2003, 11 October 2004, and 19 April 2005). Students also used the online discussion forum provided by Moodle to help each other to learn Moodle technology. For example, on 14 May 2004 a student posted a question on the website about where to put scanned worksheets, and a reply message was posted on the morning of 15 May 2004 with detailed instructions for uploading files to the website.

The examples from the design project illustrate that students in today's world are used to communicating electronically, and that online communication helps collaboration on projects even though students regularly meet face-to-face. Online interaction is expected in an informal learning community in today's digitizing world. A website for the informal learning community which considers each goal of the community helps to improve the learning outcome of the learners, to coordinate community activities, and to increase the visibility of the community in a broader context. Bruckman (1999) classified four categories of educational use of the Internet: information delivery, information retrieval, information sharing, and technological samba schools. The four categories are in the order of decreasing emphasis on information and increasing emphasis on community and the social context of learning. Based on this categorization, we view a website of the informal learning community as a place for students to deliver information, retrieve information, and share information, and one kind of technological samba school that emphasizes the role of authenticity in learning to relate the learning situation to the real world. The website of the informal learning community focuses on development of learners' informal learning ability and encourages the participation of learners at different levels of computer skills.

In this section, we discuss some design implications of the informal learning community's website, taking into



consideration that members share the same school history and meet physically on a regular basis. As this is a community not only for advanced students, but also for students who are in need of help on learning basic technology, the website should be attractive to students of all levels and should not use too much technological jargon. For example, the K-8 Interesting Projects website (<http://www.alleghany.k12.nc.us/ses/page3.htm>) uses some pictures of the projects and an image of a funny painting boy on the website to attract children to read the website, and the simple look makes it relatively easy to navigate to other web pages. Another good example is a website created by the Howard Hughes Medical Institute (<http://www.hhmi.org/coolscience/>) which is aimed at children who are interested in exploring biology. The website uses colourful and funny image icons to substitute text or buttons as hyperlinks to other web pages. The Education 4 Kids website ([www.edu4kids.com](http://www.edu4kids.com)) presents a much more professional look and may actually be less attractive to children because of its formal style. The MySQL discussion forum (<http://forums.mysql.com/>) website contains a lot of technological jargon and has a very 'cold-looking' interface, which is not attractive at all to young people who have little knowledge about MySQL. This is the last kind of interface we would suggest for designing a website for this informal learning community.

### 5.1 Provide online meeting notes with their own communication spaces

The fact that the major activities of a real-life project occur through face-to-face interactions in the informal learning community implies that the design of the community's website needs to focus on how to integrate students' collaborations in physical place into the virtual space. One technique is to provide meeting notes on the website, each with a communication space. Typically, online meeting notes function as an archive of the project only. By making the note of each meeting the topic of a threaded discussion, students can react to the meeting notes online, such as updating the status of the project after last meeting, questioning some issues discussed the meeting, proposing new understandings of the problem covered in the meeting, etc. This feature combines the communication happening in physical places with the communication happening online, assuming that it will help to integrate activities happening in physical places into virtual space. This feature can also be considered as an *interaction-oriented structuring tool* (Weinberger *et al.* 2003) which supports the students in reflecting on the meeting content, such as their decisions on the project, their proposed solutions of the problem, and their understanding of the problem context.

### 5.2 Support different views of a project in the community

By working on real problems, students interpret the process based on their own understanding of complex social phenomenon. Therefore students may hold different views of the problem and have different approaches to solving the problems. This sets another design focus of the website, i.e. to support different views of the project. In the physical setting, students discuss their own understanding of the problem during the meeting and the activity. Stahl and Herrmann (1999) argued that students should be able to construct personal views with an existing CSCL knowledge space to facilitate divergent thinking. Providing an online discussion forum for each project helps students to develop their opinions and ideas verbally in the virtual world.

### 5.3 Provide a project template to help students organize real-life projects

In a technology project in a computer course, the problem context is usually already set in the project description that is written by the course instructor, and the instructor often suggests facets or issues which should be attended to in the project. The focus of the project is often only on the implementation of the technologies, ignoring sociocultural factors that might affect the outcome if it were a real-life project. In the informal learning community, the students need to be more self-dependent when carrying out authentic activities, and find out what factors might affect the project outcome. In this context, the website can provide a *project template* as a means of helping students outline the project and organize their project brainstorming systematically when they look for other influential factors to consider in addition to technology issues. A sample *project template* is given below:

#### Project Template #1

Project Title:  
 Project Idea:  
 Team members:  
 Software needed:  
 Network issue:  
 Need coordination from:  
 Who will benefit from the outcome, and how?  
 Drawbacks/trade-off:  
 Who to contact:

Weinberger *et al.* defined *content-oriented structuring tools* as the tools that provide structures referring to the content to be learned (Weinberger *et al.* 2003). Content-oriented structuring tools foster knowledge communication in collaborative learning environments and the outcome of collaborative knowledge construction (Fischer *et al.* 2002). The authors presented one example of content-oriented

structuring tools—prompt cards with meaningful questions about the content. The project template can be viewed as a template of content-structuring tools which helps students to focus on the major issues that need to be considered in a real-life project. For example, the issue of trade-off in the project template motivates students to think and discuss the pros and cons of the project, the technology to use, the solutions of the problem, etc. Describing the project with templates also helps students to become familiar with the real-life workstyle which usually requires certain types of documentation such as reports of the work.

#### **5.4 Provide a tailored public community discussion forum with a level of anonymity**

Collaboration with others is powerful in the learning process. People learn by interacting with others and interpreting different perspectives, and by working with others and co-constructing new knowledge. One example that looks at using technology to encourage community members to help each other is the project Pearls of Wisdom (POW) which provides digital tools for the development of a network-wide community that values the contributions of technical expertise from individuals and facilitates the asynchronous sharing of this communal knowledge (Chapman and Burd 2002).

In designing a website for the informal learning community, supporting intent participation of the community activities encourages students to help each other. Supporting intent participation means supporting for observation, including watching, active listening (eavesdropping), and passive listening (overhearing). Suggestions from learners who are more experienced and discussions that are embedded in the ongoing activity often enlighten learners' keen observations (Rogoff *et al.* 2003). Making the discussion forum of the project available to all students provides a chance for students to 'listen to' what has been discussed. Making the meeting announcement and meeting minutes available provides awareness of the project process and implicitly invites all students who are interested to join in the activities.

Online discussion forums are an effective tool to support both asynchronous and synchronous discussions. Providing a community discussion forum supports members in communicating with each other about technology issues through the website. In supporting learning from collaborative design, Lid and Suthers (2003) implemented artefact-centred discourse and threads that live in multiple discussion contexts, and obtained excellent results in terms of quality and quantity of discussion in their empirical study. To support flexible collaborative distance learning, Haake *et al.* (2004) proposed a CURE learning platform which supported the implementation of a variety of tailorable learning environments. In this informal learning

community, a tailoring technique for the community discussion forum is necessary for students to exchange learning experience at different levels of computer skills. To enable students to discuss technology issues at different levels, the website can classify the community discussion forum into different sections, such as 'Advanced tech talk', 'Help you, help me', and 'What's new about tech'. On the community website, providing a keyword-based search engine that can search across the different discussion forums helps members to look for common information from different discussion context.

The traditional roles of teacher and student are challenged when teachers ask for technical help from 'technology-savvy' students. One method of helping to engage teachers in the learning community is to allow members a level of anonymity in the discussion forum of the website. Doing this makes it is less uncomfortable for teachers to join in the online discussions.

#### **5.5 Provide a project advertisement space for teachers**

Another approach to encouraging the participation of teachers through the website is to provide a place for teachers to propose teaching-related projects. For example, a physics teacher may want to demonstrate the concept of gravity using Flash, but needs help in learning Flash. She/he can propose the project idea on the website and call for students who are interested in assisting in the task. School projects, especially those that are related to teaching practices, make it easier for teachers to participate in the activities. This collaboration not only helps teachers to learn technology and integrate it into the curriculum, but also helps students to understand the idea behind the project, for example to understand better the concept of gravity when working on the Flash project with the physics teacher. Providing a separate place on the website for schoolteachers to propose project ideas explicitly encourages teachers to work with students.

#### **5.6 Provide an online information repository for maintaining local connections**

Social capital articulates the networks of trust and reciprocity in which actors are interconnected with each other (Borgatti *et al.* 1998). The more interconnected the actors are, the more they trust and share resources with each other and thus the group/organization as a whole benefits. Acknowledging those who have coordinated community projects on the website provides a positive atmosphere for creating new connections and maintaining the existing ones.

Providing a repository of connections in the website helps members to store and retrieve connection information. When the LEC teacher contacted Go Daddy for help

on the server, she sent an email to the student group as follows:

The server has been down... On Friday XXX called the service help for Go Daddy. She spoke to XX (e-mail \*\*\*\*\*). XX said we need to log in and request \*\*\*\*\*. The 800 number is \*\*\*\*\* for additional help. X hopefully will be able to help us with this. In any event, XX said to call or e-mail and he would assist us. He said it was not a problem and we should be up and running as soon as we take care of this issue.

The email implies that a connection was created between XX, the technical consultant at Go Daddy, and the online course design project. The email address of the technical consultant at Go Daddy and the 800 number are necessary information to maintain this connection and should be archived.

One student had problems with the MySQL database in a computer laboratory session. Since the teacher knew nothing about the MySQL database, she looked for technical help using her social network. She first looked for a senior student whom she knew could probably solve the problem, and when that student could not be reached, she called her son who is a website developer at the Pennsylvania State University for help. In this case, a connection was made between the LEC teacher's son and the project, based on the teacher's social network. Archiving this as a possible 'Ask for technical assistance' connection may help on other projects at some time, even if the LEC teacher is no longer the facilitator.

The community also needs to increase its visibility in the school in order to create connections. One way to do this is to provide a link to the community website on the school website.

Table 1 summarizes the techniques discussed and how they are linked to the four goals of the informal learning community.

## 6. Evaluation of the informal learning community

Acting as a complement to the formal education at school, the informal learning community offers opportunities for students to work on real-life projects and solve real-life problems. At the end of the website design project, the LEC teacher commented on the students' learning progress: 'The students have learned very much in this area [technology]'; '[they learned how to] back up the database, format new material online'. She also acknowledged that the students had learned a lot in terms of communication and collaboration skills, and have learned that '[they] need to communicate to staff and public [to make the project succeed]'. Students also acknowledged their learning progress in answering the open-ended questionnaire. For example, one student acknowledged that he had learned HTML during the process. Another student said that he had applied what he had learned in this project—how to design interface layout in the project—to many of his poster projects.

The computer skills that the students gain in participating in the activities of the community are only part of the learning outcome. After the course website had been developed, the students presented their work to

Table 1. Sample techniques of a website to foster the informal learning community.

Goals of the informal learning community	Sample techniques in designing the community website
Support students to collaborate on real-life projects	<ul style="list-style-type: none"> <li>• Integrate meeting notes into threaded discussion</li> <li>• Provide a discussion forum for each project</li> <li>• Provide project templates to help students strategize the project process and manage the projects</li> </ul>
Encourage peer help with technology learning	<ul style="list-style-type: none"> <li>• Make the discussions of the project available not only to the community members, but also to other school students</li> <li>• Enable school students who are not involved in the project to leave comments on the project discussion forum</li> <li>• Use project-centred design for web content instead of technology-oriented design (e.g. technology projects vs. technology jargon as sections for discussion forum)</li> <li>• Provide community discussion forum with different sections</li> </ul>
Encourage teachers to work with students as teams	<ul style="list-style-type: none"> <li>• Acknowledge those who have helped other students a lot in the community</li> <li>• Allow learners anonymity</li> <li>• Provide a specific place for teachers to propose project ideas related to the teaching needs</li> </ul>
Create and maintain connections with the school and the local community	<ul style="list-style-type: none"> <li>• A link to the website from the school's website</li> <li>• Acknowledging help from school staff members on projects</li> <li>• Provide a repository of connection for learners to store and retrieve connection information</li> </ul>

schoolteachers and the school administration. They organized the presentation themselves; they decided on the topics to be covered in the presentation and its format and flow, and they even designed a quiz to test how much the teachers had learnt in the presentation. The presentation was an evaluation event of the students' work and it was a great success; teachers were very impressed by the students' work and how much they had accomplished in this informal learning activity. Although the website project started with designing an online health course website, the presentation impressed English teachers who contacted the student group for help in designing online English course website. As of Fall 2005, the school is piloting the English 12 class. The students are also helping to design an online History class. The LEC teacher commented, 'the students [who are taking the English course] so appreciate it and the professor [i.e. the English teacher] is equally pleased that his students are using it to succeed in his class'.

Because of the scale and range of activities that informal learning involves, it is difficult to quantify its progression, and its impact on an individual can be long term. In general, learning progressions from informal learning activities can be classified into four categories (Foster 1997):

- personal progression where participants gain greater confidence and self-esteem, thus increasing self-efficacy (Bandura 1997), achieving better understanding of subjects, changing career plans, and improving literacy;
- social progression where participants create a wider social network and increase community participation;
- economic progression where participants get better jobs and better pay; and
- educational progression where participants continue learning in a more systematic and intentional way.

Evidence has demonstrated that community-based learning leads to significant self-development outcomes such as greater autonomy, improved personal and social skills, and significantly increased self-confidence and self-esteem (McGivney 1999, p. 79). In this online course design project, a senior student who is one of the website administrators decided to go to College of Information Sciences and Technology at the Pennsylvania State University after graduation. After the website design project, the student group formed an official computer club to continue working together exploring other community projects such as helping schoolteachers install computer software and hardware, learning to design game tools, and helping other students with computer learning. Evaluation of such an informal learning community is a long-term process. As a primary evaluator, school has the responsibility of fostering the community and guiding it to contribute to the peda-

gogical outcome and to students' success in real life in the future.

## 7. Conclusion

Computer technologies develop at a fascinatingly fast pace. One needs to keep learning new technologies in order to keep up with the rapid development of the digital world. Formal education should not only teach students basic computer skills to meet current needs, but also foster student development of informal learning ability for lifelong learning. On the other hand, schoolteachers face the challenge of integrating technology into the curriculum. Based on the experience of an online course design project, we suggest fostering an informal learning community of computer technologies at school to address the shift in educational context.

In 1916, John Dewey stated, 'From the standpoint of the child, the great waste in school comes from his inability to utilize the experience he gets outside... while on the other hand, he is unable to apply in daily life what he is learning in school. That is the isolation of the school—its isolation from life'. The proposed informal learning community helps bridge school and non-school life by encouraging students to engage in authentic activities. It has four goals:

- to support students to collaborate on real-life projects;
- to encourage peer help with technology learning;
- to encourage teachers to work with students as teams; and
- to create and maintain connections with the school and the local community.

We have discussed some implications of designing a community website to support such an informal learning community whose members meet both online and face-to-face sharing the same school context.

Postman and Weingartner (1973) discussed what a good school should be. A good school should have the time structuring that allows children to learn things at various rates and should support activities that have some empirical and rational basis and are relevant to children's lives. A good school's activities should involve a large percentage of the students' work, and should establish and maintain the connection between students' activities and scholars' work. A good school uses the resources of the whole community so that students reach real people and problems outside the school walls and encourages students with different backgrounds and ability to participate together. A good school encourages its teachers to forgo the conventional authoritarian role so as to provide a more collaborative supervision atmosphere and also gives students opportunities to supervise themselves. A good school invites people from various backgrounds, including

interested laypeople, professionals, and even students, to join teaching activities and encourages its students to participate in school administrative activities such as curriculum design. Moreover, a good school facilitates collaboration among students rather than competition so that students learn to grow together and help each other, and not how to succeed at the expense of other students.

Fostering an informal learning community at school fits the characteristics of a good school and makes the school better at educating students.

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