

Technology Supported Social Network Building and Knowledge Sharing: A Case Study of Designing an Online Community of Practice for Teachers

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This paper presents a design-based research project to build an online Community of Practice (CoP) for teacher professional development (TPD) with web 2.0 tools. CoPs provide opportunities for teachers to learn from peers, both interactively and collaboratively. In a successful CoP for teachers, practical knowledge sharing among teachers is one of the most important characteristics. To achieve this, social connections within the community cannot be overlooked. The purpose of our research is to determine how to build social networks for teachers and facilitate their knowledge sharing with the help of web 2.0 technology. During the three-year design trajectory, we finished 4 stages of community design, and developed a CoP for teachers called Libazhuang (LBZ) supported by web 2.0 tools which enable social network building and practical knowledge sharing. We started our design from a trial version of community, then we improved usability and sociability of the community, designed professional development featured modules and added social network analysis function. The development of this community was driven by users' needs. In order to get users involve in the design process, synchronous and asynchronous channels were provided to support the interaction between users and designers. In discussion section, we present our finding about community design and knowledge sharing. We suggest that social needs of users should be considered carefully in CoPs design. Usability should be well designed to enhance sociability. Channels should be provided to connect users and produce collective intelligence. In CoPs, teachers' social networks may change the way of interaction among participants. In turn, it increases knowledge sharing and creation.

Keywords: teacher professional development, community of practice, web 2.0, social network

Introduction

Teacher professional development (TPD) as an important issue to ensure educational quality attracts a great deal of attention globally. In China, TPD has its own unique characteristics. Due to the unbalanced educational status, especially between the eastern and western parts of the country, we have a large number of teachers who are at various levels of professional development. Those teachers share similar demands of TPD and have much in common in their daily work. To meet their professional development demands, face-to-face training and blog-based reflection are the most frequently used solutions. However, debates are taking place about these solutions. Their limitations are being gradually revealed.

Face-to-face training projects are often designed and delivered by university researchers and educational authorities, and last for only a few days. Theories and principles are often their main contents. Teachers may find these training sessions not enough to help their daily work.

Blog-based reflection gives teachers good opportunities to review their work. But it is not sufficiently effective to support in-depth interaction and collaboration.

To overcome these obstacles, Community of Practice (CoP) is a promising solution. CoPs are social and technical ecologies in which knowledge is retained and created (Wenger, 1998). This definition reveals the two core issues of CoPs, which are social relationship and knowledge sharing. Social relationship could provide powerful support for knowledge sharing.

CoPs benefit from the advancement of new technology. Emerging new technology, such as Web 2.0, has changed the way online interaction takes place. On the whole, new types of community Social Networking Sites (SNSs) like Facebook have already achieved great success. The prevalence of SNS and other Web 2.0 technology can also shed a light on CoP design.

We suggested that a CoP with Web 2.0 and SNS can contribute to social relationship building, and in turn improve the knowledge sharing process. From this viewpoint, we started our community design study.

Literature Review

From the definitions provided by Wenger, social relationship and knowledge sharing are two wheels of CoPs. From a technical aspect, CoPs are online platforms supported by various web technologies.

To gain a deeper understanding of CoPs, we started our literature review from social, knowledge-based and technological perspectives.

Social Perspective of CoPs

A CoP is a set of relations among people, activities and the world (Lave & Wenger, 1991). It is a persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and experiences focused on a common practice and/or mutual enterprise (Barab, MaKinster, & Scheckler, 2003).

In CoPs, there are always connected people negotiating and working toward a common goal (Baek & Barab, 2005). Social connections are the basis of in-depth online interaction and further collaboration. With social connections, trust and shared understanding can be built and then improve information exchange, knowledge sharing, and knowledge construction. To build a CoP, a social network should first be established.

Knowledge-Based Perspective of CoPs

Knowledge sharing and creation are important indicators of the success of CoPs. Among different kinds of explanations of knowledge in community, the SECI mode is widely accepted in knowledge management field, which interprets knowledge sharing and creation as a spiraling process (Nonaka & Takeuchi, 1995). The Knowledge Spiraling consists of 4 stages, which are socialization, externalization, combination and internalization. These four stages indicate knowledge construction among individual, group and whole community. The SECI model is also used to explain the knowledge flows in online teachers' community (Lin, Lin, & Huang, 2008).

SECI inspires us in two important ways which are knowledge construction and relationship building. Firstly, the knowledge sharing and creation among individuals, groups and community can be explained as different kinds of knowledge construction. Knowledge construction starts from individual level. And then, knowledge spread to group and community level. Secondly, relationship is very important to knowledge sharing. Different kinds of relationships can be built in CoPs. These relationships influence the way of interaction and, in turn, the knowledge sharing process (Li, Sun, & Zheng, 2011).

Technological Perspective of CoPs

The decentralized feature of Web 2.0 technology changed our communication pattern (O'Reilly, 2005). In CoPs, user participation can be enhanced greatly with the support of Web 2.0 tools. The new development of Web 2.0, namely Web Squared, attached great importance of collective intelligence from users (O'Reilly & Battelle, 2009). In the era of Web Squared, users' behavior should be taken into consideration in web platform design. In the meanwhile, the huge success of social network sites like Facebook revealed how powerful social network could be. Web 2.0 technology and the design pattern of SNSs can benefit CoPs design profoundly.

Literature has shown that an online CoP supported by Web 2.0 technology might be a solution to social network building, knowledge sharing and online collaboration. With this understanding, we started our community design process.

Methodology

Design-Based Research

Overall, our study is design-based research, which is aimed at improving educational practices through systematic, flexible, and iterative review, analysis, design, development, and implementation, based on the collaboration among researchers and practitioners in real-world settings, and leading to design principles or theories (Wang & Hannafin, 2005).

Design-based research can be traced back to design experiments advanced by Ann Brown (1992) and Allan Collins (1992). This research methodology is characterized by iterative cycles of design, implementation, analysis, and redesign. In this iterative process, practice is amended gradually. Experience accumulated from practice can be abstracted to theory.

Our purpose is to build an online CoP for teachers with web 2.0 technology. Our study contains 4 stages. In each stage, we followed the procedure of design, implementation, feedback and analysis. These 4 stages will be introduced in detail in section on Community Design.

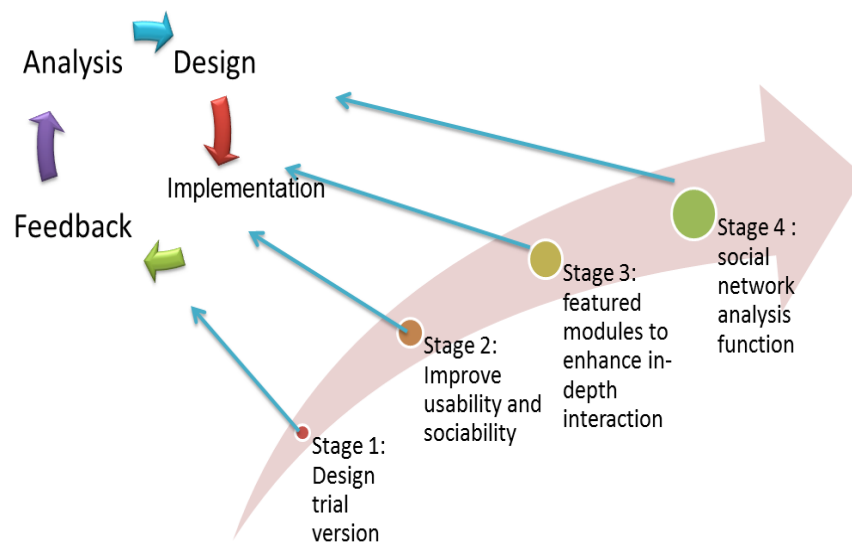


Figure 1. Stages of community design

Participatory Design

Participatory design (PD), rooted in socio-technical systems theory, is attach great importance to user participation in the design of community (Schank, Harris, Fusco, Schlager, & Farooq, 2007). It enables end users to state problems and give suggestion to improve function modules.

In this research, we build different channels to enhance interaction between end users and designers. With these interactions, users understood what technology could do for their professional development and designers learned about how to better their design in order to meet the users' needs. The interactions occurred online in both synchronous and asynchronous manners. Four kinds of channels were built to support interactions between users and designers, which were Google Doc, Forum, Email and QQ (Instant Message Tools in China).

We built up a web form with the support of Google doc. Users could input their suggestions and submit them. Their comments were then sent to a Google sheet document. It was very convenient for us to check new feedback. When Google doc was not available in mainland China, we used a forum in our community to accumulate users' feedback. QQ is the most widely used instant message tool in China. We used QQ as another channel because most users of our community were frequent users of QQ. QQ has its own Email system. Group Email is a feature of QQ. If users join a QQ group, they can compose and receive Group Emails which can easily reach all members of the group.

Besides feedback provided by users, we also used a multitude of quantitative and qualitative instruments in data collection. The main methods of data collection were users' surveys, users' activity logs and user generated content (UGC), such as blogs, wiki entries and online meeting records.

Community Design

Brief Introduction to the Libazhuang Community

Our community is called Libazhuang (<http://www.peercoaching.cn>). The latest version of the Libazhuang community uses the pattern of Social Networking Sites (SNS) as its main structure. After logging in, users can easily establish personal connections via a “Friends” module with other users. If users become “Friends”, the community keeps them updated regarding their friends’ online activities, such as publishing a blog, editing a wiki, answering a question, etc. As a result, users become closely connected. Users can establish groups according to their common interests, and group members have more ways to collaborate with each other.



Figure 2. The home page of the Libazhuang community

We designed function modules to aid users’ online professional development. The modules include: Blog, Wiki, Sharing, Question, Forum, Repository, Group, Online Mentor-ship, and Expert Teacher Studio. These modules offer opportunities for information sharing, and ease of collaboration. As shown in Figure 3, users can access these modules easily through the navigation bar on the left of the screen.



Figure 3. Auser's personal homepage

Figures 2 and 3 show the newest version the Libazhuang community. The design process of the community last for 3 years. There are 4 stages in the community design.

Stage 1 Trial Version (2009. 1 to 2009. 7)

We started the design of trial version based on literature review, influential Web 2.0 community and a focus group.

In this version we designed many function modules to cover all the needs of teachers' online professional development. The modules include Friends, Group, Repository, Blog, Wiki, Instant Message, Question, Collaborative Lesson Preparation, Collaborative Research, Forum, and Video Conferencing. We hypothesized that these modules could work together smoothly and provide powerful assistance to teachers' professional development activities.

We gained 3 valuable findings through the feedback from users and other data collected. First, although many modules were provided, only 4 modules were frequently used, which are Blog, Friends, Question and Repository. Second, novice users were often bewildered when they logged in and faced so many function modules. It seemed that they need more instructions about how to use these modules. Third, there were few instances of frequent interaction in our community. These results revealed 3 important problems of our design.

Regarding function modules, providing as many functions as possible may not be a good solution. The most frequently used modules indicated the needs of teachers. The Friends module established a social network with other users. The Question module helped teachers to find answers of their practical problems. The Repository offered teaching resources that could be easily reused. The Blog served as a reflection tool which was most familiar to teachers. These modules showed the needs of community users. Although they didn't totally overlap with the aim of a successful CoP for teachers, these needs were important starting point of CoP building.

Regarding the confusion of new users, it showed that the usability of our community had to be improved. Better instructions should be given to novice users to help them gain familiarity with the community.

Regarding the lack of frequent interaction, the main reason might be a loose social network. Social connections in our community were not enough. Visiting friends' personal home pages was the only way to get latest news about their friends. Users need more real-time information from their friends to maintain social ties.

With these new findings, we started the second stage of community design.

Stage 2 Improve Usability and Sociability (2009. 8 to 2010. 1)

All the problems found in stage 1 can be considered information structure. To solve these problems, we decided to redesign the information structure of the community. First, we redesigned the navigation of the community to improve usability. In the new version, when new users logged in, they can only saw most frequently used modules. Simple but clear instructions were also provided to help under the function of modules. A series of tasks were designed to help new users establish social connections to active users in community. When novices get familiar with these modules more modules will show up.

Second, to improve users' social networks, we built more social connection channels. One channel, named Message Push, let users know all the real-time news from their friends, such as composing a blog, editing a wiki entry, or uploading a new video. The other channel was a new module named Sharing, which enabled users share everything they interested in with their friends, such as blogs, interesting questions, and multimedia resources.

After the modifications mentioned above, we gathered feedback and data from users. Analysis showed that our design improved the usability of the community. Users built better social connections than last version. Number of friends is an important indicator of user's social connections. At the end of 2010.3, users' average number of friends had increased 65% than 2009.7 (from 2.3 to 3.8). Accordingly, more online interactions were found in the community. From 2009.3 to 2009.7, there were 15,312 interactions recorded in database. From 2009.12 to 2010.3, there were 29,654 interactions recorded. Taking the increase of users in consideration, there was still a big increase of interactions among users.

Although more interactions could be found in our community, further analyses showed that most interactions were just in social level. We chose 10 most active users in our community and analyzed their interactions with other member in a week. The results turned out that 63.5% of the interactions were

mainly greetings, such as “how are you doing”, or simple comments, such as “your new blog is very good”. In-depth professional interactions could not be easily found.

How to trigger more inaction to improve professional development became the main task of the next stage.

Stage 3 Design TPD Featured Modules (2010. 2 to 2010. 8)

To increase in-depth professional interaction, based on social capital theory and the successful experience of traditional school-based professional development, we designed two new modules to enhance online professional development.

With regards to social capital, we understood the importance of both strong ties and weak ties. Weak ties were featured in relatively greater frequency although on a more shallow level. Strong ties, on the other hand, usually appear in few numbers but greatly influence online collaboration (Suh & Shin, 2010).

In our previous design, all the functions provided support to establish and maintain weak ties. However, to get in-depth interaction, more strong ties need to be built. In traditional school-based teacher professional development mentor-ship had been proved to be an effective way. In mentor-ship, experience teachers and novice teachers become mentors and mentees. Experienced teachers give advice to novice teachers in order to help them to gain professional development.

We borrowed this idea and designed two new modules, which are Online Mentor-ship and Expert Teacher Studio. Online Mentor-ship Module enabled users from different schools, even difference regions become mentors and mentees. This module provided a series of steps to established in-depth interaction between mentors and apprentices, which were the mentorships contract, literature study, collaborated teaching, and action research.

Expert teachers are import influencers in online community. Expert teacher studio was a module for expert teachers sharing their experience. In this module, each expert teacher provided their publications, gave lectures through online videoconference and prepared 3 topics for discussion. All users in the community could choose to “Follow” expert teachers so as to get updates and join discussions.

In this stage, analyses showed that Expert Teacher Studio and Online Mentor-ship became new frequently used modules. With the help of these 2 modules, online interaction was greatly enhanced. More collaboration started both online and offline.

However, frequent and in-depth interaction led to another problem. Teachers started to report that there was too much information pushed to them. It was difficult to find the useful ones. Additionally, social connections become complex and difficult to manage.

Stage 4 Automatic Social Network Analysis (2010. 9 - Present)

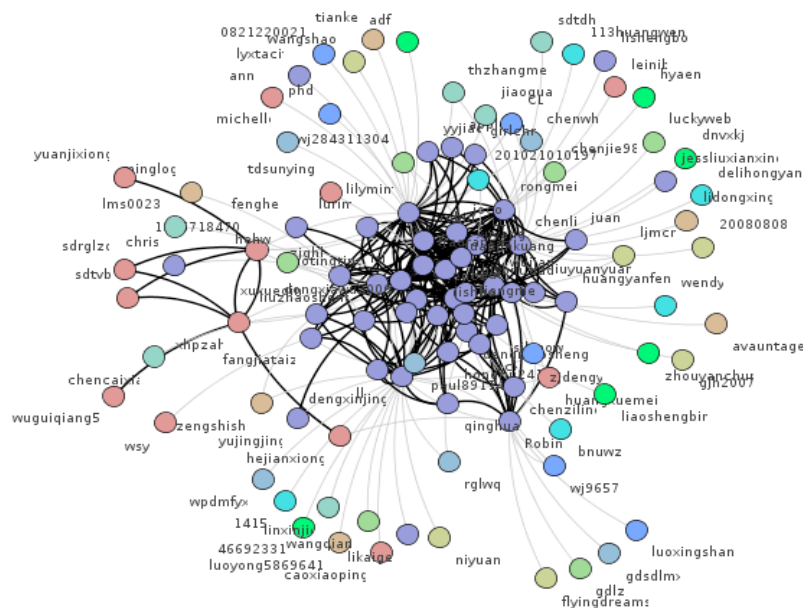
To manage their social connections in an effective way, users should know the real condition of their online interaction with other users. In previous design, the Friend List was the only clue to their network. But this list could not reveal how users interact with their friends. Lots of users have many friends they rarely interact with. The Friend List was far from enough to show the real social network of users.

We started to solve this problem from an automatic analysis of users’ social networks. To achieve that goal, we recorded online behaviors of users in database. With these data, we could find out how they interact with each other. For example, when one user gave comments to another users’ blog, this behavior was recorded and counted as an interaction between these two users. In a visualization way, a line was draw between them.

With this new function, participants can easily find the whole picture of their social network based on their real online activities. As shown in Figure 4, among all the friends they can find who are more close to them, who interact with them more frequently, and who is the “Bridge” to other users and groups.

Automatic social network analysis also makes a recommendation system possible, which can help users find out which users he should pay more attention to. A recommendation system based on social network also works as a filter to information pushed to users. It could be a possible solution to the problem mentioned in the end of Stage 3. The design of recommendation system is still on-going.

By the end of Mar. 2011, the teachers’ average number of friends was 5, and maximum was up to 48. 940 teachers attended groups and there were 79 groups built in the community. The average number of teachers per group was 11, and maximum was up to 132.855 blogs received comments and 115 questions asked by teachers got feedbacks. A wider teacher social network was established in the community.



Discussion

The four stages of community design show iterative cycles of design, implementation, analysis, and redesign. Through this process we get a deeper understanding of how to design a CoP for teachers.

Our findings can be summarized as 3 pairs of design factors, which are Usability and Sociability, Social network and Knowledge sharing, and Channel and Function.

Usability and Sociability

Usability decides how easily users can use the function modules provided by the community. Well-designed usability can help users gain familiarity with modules in short time. In a CoP, usability is not only related to separate function modules, but also related to connections needed to be built among users.

Sociability is concerned with social networks in CoPs. Social network is one of the most important factors to CoPs. In our design, social relationship is the basis of online professional development. The reason why participants join our community is there are people they interested in communicating with. They can get peer support from the social networks established in community. The ease that community participants interact with each other also depends on usability of community.

From these view points, usability design should be well designed to enhance sociability. Information structure should be planned carefully. Usability in CoP is not only concerned with how users use platform, but also how they connect with other users.

Social Network and Knowledge Sharing

In our community, knowledge sharing and creation among individuals, groups and the whole community can be explained as different levels of knowledge construction (Li, Sun, & Zheng, 2011). The knowledge construction was influenced greatly by social network in community. Various kinds of social connections can affect different levels of knowledge construction.

The original knowledge may come from some individual users. Other users socially connected to them are more likely influenced and construct their own knowledge. Individuals with common interests will form various kinds of groups, which are another type of social connection. In groups, more knowledge is likely to be shared and created. Then group members interact with other users' outside groups. Finally, knowledge can be shared to other groups and form community knowledge. In this process, social network influences knowledge sharing and creation greatly. Teachers' social networks built in our community changed the way of interaction among participants. In turn, it increases the sharing and creation process of knowledge.

Channel and Function

In the very beginning of community design, we attached great importance to support to teachers' professional development with many function modules. We tried to use the richness of function to attract users. However, in the design-based research process, we began to realize that function was important but not enough to ensure the success of a CoP. In CoPs, function modules are not just powerful tools provided to individually use, but, more importantly, channels gather users together to produce collective intelligence. It is the channels that decide the value of community.

In our community the two most successful modules, Online Mentor-ship and Expert Teacher Studio, are both served as channels to connect users. In these two modules, users are connected by a series of activities that planned in advance. In this way, users have more and deeper professional development with each other. As a result the wisdom of users is accumulated by these 2 channels. The power of connection was confirmed.

George Siemens (2005) suggested that Connectivism was the new explanation of learning in digital age. Connectivism integrated chaos, network, and complexity and self-organization theories. Siemens holds that knowledge is distributed across a network of connections. The connections of people are the basis of knowledge sharing. In our research, we find that when the connections are established the online interaction is increased and knowledge sharing is promoted.

Future Study

In future, we will build a recommendation system based on online-behavior analysis, which can help users make decisions about what to do in the community and who to connect with. This system will also help users find out the important information from all information pushed to them.

We will also conduct analysis to the interaction pattern of community. This analysis will answer 2 questions. Firstly, what is the overall interaction pattern in our community? Secondly, is there any difference between the interactions in different modules? If the answer is yes, what is the difference?

Finally, we will pursue confirmation of our hypothesis to the evolution between web tools and interaction. We argue that there might be an evolution between difference web tools and online interaction. New tools will supply new ways of interaction. New interaction ways in turn will catalyze new features of tools. In further study, we will use the design process and interaction analysis to confirm or denial this hypothesis.

References

- Baek, E. O., & Barab, S. A. (2005). A study of dynamic design dualities in a web-supported community of practice for teachers. *Educational Technology & Society*, 8(4), 161-177.
- Barab, S. A., MaKinster, J. G., & Scheckler, R. (2003). Designing system dualities: characterizing a web-supported professional development community. *The Information Society: An International Journal*, 19(3), 237-256.
- Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, 2(2), 141-178.
- Collins, A. (1992). *Towards a design science of education*. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15-22). Berlin, Heidelberg: Springer Berlin Heidelberg.
- De Souza, C. S., & Preece, J. (2004). A framework for analyzing and understanding online communities. *Interacting with Computers*, 16(3), 579-610. doi:16/j.intcom.2003.12.006
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York, Cambridge University Press.
- Li, S., Sun, H., & Zheng, X. (2011). *A case study on design of teacher peer-coaching activities supported by a web 2.0 community*. In R. Kwan, J. Fong, L.-for Kwok, & J. Lam (Eds), *Hybrid Learning*, 6837, 40-50. Berlin, Heidelberg: Springer Berlin Heidelberg.
- Lin, F., Lin, S., & Huang, T. (2008). Knowledge sharing and creation in a teachers' professional virtual community. *Computers & Education*, 50(3), 742-756.
- O'Reilly, T. (2005). *What is web 2.0*. Retrieved January 31, 2012, from <http://oreilly.com/web2/archive/what-is-web-20.html>
- O'Reilly, T., & Battelle, J. (2009). *Web squared: Web 2.0 five years on*. retrieved January 31, 2012, from <http://www.web2summit.com/web2009/public/schedule/detail/10194>

- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation?* Oxford University Press, New York.
- Schank, P., Harris, A., Fusco, J., Schlager, M., & Farooq, U. (2007). Sustaining a community computing infrastructure for online teacher professional development: A case study of designing tapped in. *Computer Supported Cooperative Work*, 16(4-5), 397-429.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*. Retrived June 30. 2012, from http://www.itdl.org/Journal/Jan_05/article01.htm
- Suh, A., & Shin, K. (2010). Exploring the effects of online social ties on knowledge sharing: A comparative analysis of collocated vs dispersed teams. *Journal of Information Science*, 36(4), 443-463. doi:10.1177/0165551510369632
- Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5-23.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY, USA: Cambridge University Press.