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WORKING PAPER

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**PRELIMINARY REQUIREMENTS OF
SOCIAL NAVIGATION IN A VIRTUAL
COMMUNITY OF PRACTICE**

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Samenvatting

Het onderwerp van dit project was het vaststellen van de gebruikersbehoeften aan sociale navigatie binnen een community of practice. De uiteindelijke gebruikers van deze omgeving zijn nieuwe leraren (met name zij-instromers) van basisscholen en scholen voor voortgezet onderwijs in Nederland. Het project werd uitgevoerd aan de Open Universiteit Nederland.

De behoeften werden bepaald door verschillende benaderingen te kiezen die aansloten bij de achtergrond en aard van het project. De basisbehoeften werden door theoretisch onderzoek achterhaald. Daarna werd een gebruikersonderzoek door middel van een elektronische vragenlijst uitgevoerd. Aangezien het concept van sociale navigatie in een virtuele omgeving voor nieuwe leraren tamelijk nieuw is en de meeste beginnende leraren op dit moment nog geen enkele ervaring hebben in een community of practice, was het moeilijk hun werkelijke behoeften ten aanzien van dit concept te achterhalen.

Om meer behoeften vanuit het gebruikersperspectief te achterhalen is een vergelijkbare gebruikersgroep in een functionerende virtuele omgeving geobserveerd en zijn de behoeften van deze groep geanalyseerd. Het onderzoek naar deze virtuele omgeving leverde meer gebruikersbehoeften op ten aanzien van zowel virtuele omgeving als sociale navigatie. Om meer mogelijke informatiestructuren en sociale navigatiebenaderingen te achterhalen werden meer vergelijkbare virtuele communities, als de CoWebs, weblogs en Usenet-sites geanalyseerd en vergeleken. Op basis van deze resultaten werd een aangepast CoWeb gereconstrueerd. Het werd door een klankbordgroep beoordeeld en van feedback voorzien. De klankbordgroep bestond uit de projectleider, een hoogleraar die expert is op het terrein van communities of practice en drie leraren opleiders. De meeste van hen waren goed bekend met de gebruikersdoelgroep. In de uiteindelijke gebruikersbehoeften zijn de resultaten uit beide studies gecombineerd.

Er werd een conceptueel ontwerp gepresenteerd om een globale indruk te geven hoe deze behoeften waren weer te geven en voldeden op user-interface niveau.

Sociale navigatie in een community of practice is een mogelijkheid om via sporen van sociale activiteit informatie te achterhalen. In tegenstelling tot een community of practice vormt sociale navigatie op zich echter geen gemeenschappelijkheid. Het definiëren van gebruikersbehoeften op het gebied van sociale navigatie is niet mogelijk zonder de context van de community of practice. Tijdens dit onderzoek bleef de community in een conceptueel stadium. Hoewel we het concept trachten te onderbouwen met vergelijkbare instrumenten en enige verbeeldingskracht blijven de resultaten van dit onderzoek beperkt

SUMMARY

The objective of the project was to define the user requirements of social navigation in a “community of practice”. The end users of the system are the new teachers (‘zij-instromers’) from primary and secondary schools in the Netherlands. The project was carried out at the Open University of the Netherlands.

The requirements were defined using different approaches according to the background and the nature of the project. Theoretical studies gave the primary requirements. We then conducted a user study using online questionnaire. Since the concept of the social navigation in a virtual space for the new teachers is rather new, and most of the new teachers currently do not have experience in any community of practice, it was difficult to collect the real needs from them with respect to this concept. Therefore, in order to find more needs from the users’ perspective, a similar user group in an ongoing virtual environment was observed and their requirements analyzed. The study on this virtual environment generated more user requirements for both virtual space and social navigation. To get possible information structures and social navigation approaches, more similar virtual community systems, namely the CoWebs, the weblogs and the Usenet sites were analyzed and compared. Based on these results, a modified CoWeb was mocked up. It was walked through by a committee and feedback was collected. The committee consisted of the project owner, a professor who is an expert in the field of communities of practice, and three trainers from teacher training centers. Most of them knew the target users very well. The final user requirements combine the results from these studies.

A conceptual design is presented, roughly to show how these requirements could be reflected and satisfied at a user interface level.

Social navigation in a community of practice is an approach of locating information with increased social awareness in the community. Social navigation alone is not a system, whereas the community of practice is. User requirement definition on social navigation is not possible without the context of the community of practice. In this project, the community of practice remains at the stage of a concept. Although we tried to ground this concept with similar systems and some imagination, the result of this study stays preliminary.

TABLE OF CONTENTS

SUMMARY	I
TABLE OF CONTENTS	III
1. INTRODUCTION	1
1.1. THE OBJECTIVE OF THE PROJECT	1
1.2. STRUCTURE OF THIS REPORT	2
2. SOCIAL NAVIGATION IN COMMUNITIES OF PRACTICE	3
2.1. COMMUNITIES OF PRACTICE	3
2.1.1. <i>Definition</i>	3
2.1.2. <i>Participation</i>	4
2.1.3. <i>Providing support</i>	6
2.2. SOCIAL NAVIGATION.....	7
2.2.1. <i>Definition</i>	7
2.2.2. <i>Social navigation and general navigation</i>	8
2.2.3. <i>Social navigation in real world and virtual place</i>	8
2.2.4. <i>Forms of social navigation:</i>	8
2.2.5. <i>Types of social navigation</i>	9
2.3. SOCIAL NAVIGATION IN VIRTUAL COMMUNITY OF PRACTICE	11
2.4. GETTING STARTED	11
3. TARGET USER GROUP	13
3.1. PROCEDURE.....	13
3.2. USER PROFILE.....	14
3.2.1. <i>General information</i>	14
3.2.2. <i>Computer skills</i>	14
3.2.3. <i>Communication</i>	14
3.3. REQUIREMENTS ACCORDING TO THE USER PROFILE	15
3.4. DISCUSSION.....	16
4. TEACHER FOCUS: AN ONGOING ONLINE COMMUNITY	17
4.1. “TEACHER FOCUS” COMMUNITY.....	17
4.2. OBSERVATIONS	19

4.2.1. <i>User groups</i>	19
4.2.2. <i>Statistical Information</i>	19
4.2.3. <i>A use scenario</i>	20
4.3. FINDINGS	21
4.4. SOCIAL NAVIGATION IN “TEACHER FOCUS”	23
4.4.1. <i>History enriched environment</i>	23
4.4.2. <i>Intended social navigation</i>	24
4.5. USER REQUIREMENT ANALYSIS	24
4.5.1. <i>Benefits</i>	24
4.5.2. <i>Other requirements</i>	25
4.6. DISCUSSION	26
5. COMPARING THREE ONLINE COMMUNITY SYSTEMS	27
5.1. CoWEB	27
5.2. WEBLOG	28
5.3. USENET	28
5.4. DISCUSSION	29
5.4.1. <i>Benefits comparison</i>	29
5.4.2. <i>Social navigation</i>	30
6. MODIFIED COWEB	31
6.1. DESIGN DECISIONS	31
6.1.1. <i>Why CoWeb</i>	31
6.1.2. <i>Other Considerations</i>	32
6.2. FUNCTIONAL DESIGN	32
6.2.1. <i>Top-level accessibility</i>	32
6.2.2. <i>Registration and customization</i>	33
6.2.3. <i>Collaborative editing</i>	33
6.2.4. <i>Social navigation</i>	34
6.2.5. <i>Online chatting</i>	35
6.3. FEEDBACK	1
7. SUMMARY OF THE REQUIREMENTS	37
7.1. REQUIREMENTS ON THE COMMUNITY OF PRACTICE	37
7.1.1. <i>Benefits</i>	37
7.1.2. <i>Social awareness</i>	41
7.1.3. <i>Management issues</i>	41
7.2. THE BASIC STRUCTURE AND ACTIVITIES	42
7.2.1. <i>Metaphor</i>	42
7.2.2. <i>Basic structure</i>	42
7.2.3. <i>Activities and social navigation</i>	44
7.3. REQUIREMENTS ON SOCIAL NAVIGATION	46
8. A CONCEPTUAL DESIGN OF SOCIAL NAVIGATON	48
8.1. LOCAL SOCIAL NAVIGATION CUES INSIDE A PAGE	49
8.2. LOCAL SOCIAL NAVIGATION CUES ABOUT A PAGE	52
8.3. GLOBAL SOCIAL NAVIGATION CUES	54
8.4. DISCUSSION	56
9. DISCUSSION AND CONCLUSIONS	57
9.1. SOCIAL NAVIGATION: THE NEW CONCEPT	57
9.2. CHALLENGES	57
9.3. METHODOLOGIES	58
9.4. VALIDITY OF THE USER REQUIREMENTS	59
9.5. CONCLUSION AND FUTURE WORK	59

10. ACKNOWLEDGMENTS.....	60
APPENDIX A: QUESTIONNAIRE (DUTCH VERSION)	61
APPENDIX B: THE ANSWERS OF QUESTIONNAIRE.....	65
APPENDIX C: MODIFIED COWEB.....	67
REFERENCES.....	72

1. INTRODUCTION

In companies people meet together during the coffee break. They talk to each other thereby sharing their knowledge, experience and expertise about their work. They are informally bound by what they do together and thus they form an implicit community of practice. The virtual communities of practice are geographically distributed groups of individuals who participate in these activities.

People typically pay a lot of attention to the behavior of others when they navigate information in the physical space. Social navigation is the navigation that mainly considers people, their actions, and the traces left by these actions.

1.1. The objective of the project

The aim of the project is to define the user requirements for designing social navigation in a virtual community of practice. The target users of the system are the new teachers (zij-instromers) who are currently teaching in primary or secondary schools in the Netherlands and at the same time learning to gain the education certification. There are many interesting questions in this project:

- What is the relationship between communities of practice in real environments and in virtual spaces?
- What are the essential factors for virtual communities of practice to be successful?
- For the social navigation, what are the relationships and differences between social navigation in real environments and social navigation in virtual spaces?
- In a virtual space, how do people orient and guide themselves, and how do they interact with and make use of the others to find their ways in information spaces?
- What is the relationship between social navigation and virtual communities of practice?

Answering these questions gives this project basic understanding of the primary user needs in the domain, but we need to involve other user research methodologies to explore further what these requirements are for this particular user group. Several user research methodologies were used in this project and it is reflected in the structure of this report.

1.2. Structure of this report

This report will first show in Chapter 2 some literature study results about social navigation in virtual communities of practice. The literature study comes into a conclusion that we cannot completely define the requirements on the social navigation but we should do it in a bigger context – the requirements on the community of practice. We should focus on what a user can benefit from the community of practice, and how it could be achieved. This would lead us to the proper approaches of social navigation.

In Chapter 3 the end-user study led the first step. Since using the social navigation in the virtual place for the new teachers is a new concept and most of the new teachers currently do not have experience in any community of practice, it is a bit difficult to collect the real needs from them for the new system. In order to find more needs from the users' perspective, a similar user group of an ongoing virtual environment was observed and their requirements were analyzed, which is presented in Chapter 4. The user study on this virtual environment generated more user requirements for both virtual space and social navigation. To get possible information structures and social navigation approaches, more similar virtual community systems, namely the CoWebs, the weblogs and the Usenet sites were analyzed and compared in Chapter 5. It was followed by a modified version of CoWeb as the first concept mockup in Chapter 6. The mockup was walked through by a committee and feedback was collected. The committee consisted of the project owner, a professor who is an expert in the field of communities of practice, and three trainers from teacher training centers. Most of them knew the target users very well. In Chapter 7, the final user requirements combined the results from these studies.

Chapter 8 presents some design concepts, roughly to show how these requirements could be reflected and satisfied at a user interface level.

Chapter 9 concludes this report with some discussions.

2. SOCIAL NAVIGATION IN COMMUNITIES OF PRACTICE

This project is to find out in which ways the social navigation can help the new teachers to locate and exchange information in a virtual community of practice and what their real needs are in terms of social navigation. The system is still at a very early concept stage, that is, we don't know yet what such a system will look like and how it will function. So before we do any user research, we need to understand what exactly the community of practice and the social navigation are, and how they are related, so that we can narrow it down to get started.

2.1. *Communities of practice*

2.1.1. Definition

There are abound definitions of communities of practice. However, most credible definitions include some key elements. They describe the communities of practice (Wenger 1998b):

- Generate and share knowledge, experience and expertise;
- Focus on learning, improving a practice, and getting work done;
- Pursue a common sense of purpose;
- Need to know what each other knows;
- Include a collective repertoire of activities and means of participation;
- Persist over an extended period of time.

A Research Team from Brigham Young University stated an operational definition of communities of practice (Allen et al., 2003):

Groups of individuals who participate in a collection of activities, share knowledge and expertise, and function as an interdependent network over an extended period of time with the shared goal of furthering their 'practice' or doing their work better.

Communities of practice are informal learning environments and have already existed in workplace settings for centuries (Lave and Wenger 1991, Wenger 1998a, Wenger and Snyder 2000). An example of a Community of Practice would be a group of maintenance engineers who meet up every day during the coffee break to share tips

and ideas. Through these informal meetings, the groups share their combined knowledge, thereby raising the collective competence of the group as whole.

Originally, Communities of practice involved people who were close to each other geographically and shared the same surroundings. The communities of practice can also function in a distributed environment since the communication can be performed via electronic media, such telephone, email, voice mail, and video conferencing. For the distributed communities of practice, the face to face contacts are also important and necessary to maintain the membership and thus develop the communities (Lueg 2000a,b). Nowadays, communities of practice exist in many organizations to help employees to organize their work and to develop their new capabilities.

As the technology develops, the communities of practice are going toward virtual ones. The members of a community of practice interact in an online environment, sharing a Web space, using email lists, discussing in forums and chatting synchronously. The BYU Research Team defined the virtual communities of practice (Allen et al., 2003):

Virtual communities of practice are physically distributed groups of individuals who participate in activities, share knowledge and expertise, and function as an interdependent network over and extended period of time, using various technological means to communicate with one another, with the shared goal of furthering their “practice” or doing their work better.

Different from the communities of practice in the real environment, members may not see each other face to face. They use mediated communication tools in the virtual space. They meet online in the chat room synchronously. They have asynchronous discussion in newsgroups. They present themselves and their knowledge on the web pages to others. They ask for help by using mailing lists. The membership building and maintenance cannot be done through physical contact although the importance of regular face to face communication stressed by Li and Williams (F. and H. 1999).

In a community of practice, the participation and providing support are important issues as discussed below.

2.1.2. Participation

Participation in most communities of practice is voluntary. Therefore it is essential to the evolution of a community of practice and to build membership and trust (Kimble et al., 2001). It decides whether the community of practice is successful or not.

Participation in a community of practice consists of three stages. First the users spend some time browsing and observing. They try to find some useful information which is worth reading and can solve their problems. Then after several times of successful browsing and find it is useful place, they start asking questions or contributing their ideas, information and knowledge. Finally if they found they can get satisfying answers or their contributions are appreciated by other users and are valuable for them,

they will continue to use this system. The system should satisfy all the users that are in these three stages.

There are three aspects influencing the participation:

Benefits

A community of practice thrives because participation has benefits to its members (Wenger et al., 2002). A community of practice's life is determined by the value it provides to its members. The benefits for the members can be concluded from (Wenger 1998b), the Research Team (Allen et al., 2003) and David (Millen et al., 2002).

- Providing an efficient idea exchange;
- Providing high quality content;
- Helping for problem solving;
- Helping people do their jobs;
- Helping develop individual skills and competencies;
- Providing greater access to experts;
- Increasing members' motivation to learn;
- Providing challenges and opportunities to contribute;
- Developing professional relationship.

If communities of practice don't provide some of these benefits to meet the needs of the participants, they will stop using them. Which benefits that the communities of practice should offer depends on the users' needs.

Methods of knowledge sharing

People use different methods to achieve their goals in the community of practice. By investigating several ongoing virtual communities of practice, the BYU Research Team found that members used following methods for knowledge sharing (Allen et al., 2003):

- Asking and answering questions;
- Having access to experts;
- Problem solving;
- Resource and information sharing;
- Creating smaller communities around special interesting topics;
- Collaborating.

"Having access to experts" was ranked the highest level for most helpful activities to complete members' job.

Community of practice as social space

If the users perceive the community of practice as a social space, they will be more motivated to participate. There are three main factors that may influence this perception.

Social awareness

Dourish provides with a general definition: “*awareness is an understanding of the activities of others, which provides a context for your own activity*” (Dourish and Bellotti 1992). This concept can be extended in the virtual space as being aware of the others and their activities either at present or in the past.

The awareness of others’ presence may make people feel that the space is alive and might make it more inviting (Dieberger et al., 2000). The awareness of others’ actions may inform people what is appropriate behavior, what can or cannot be done (Wenger et al., 2002). Moreover, social awareness may motivate people to stay longer in the space and be engaged in more actions.

The following question will be related to the social awareness when one is in the virtual place:

- Who is present or on-line?
- Who is available now?
- What are they doing? What did they do?
- Where are they and how can I reach them? Where were they?

Social interaction

As people gain the social awareness and feel they are within a social space, they can further interact with others. The social interaction can help people build trust and relationships among them. With established trust and relationships, people are more willing to participate.

Social navigation

Social navigation is the navigation that mainly considers people, their actions, and the traces left by these actions. It will be introduced in detail in the next section.

With social navigation support, the member can guide themselves in the community of practice through others’ activities, and traces left by others. It will enhance the sociability of communities of practice and therefore enhance the willingness of participation.

Social navigation may also help members navigate to important information quicker and have a better overview of the space (Lonnqvist et al., 2000).

2.1.3. Providing support

“*Communities of practice develop around things that matter to people*” (Wenger 1998b) and they are fundamentally self-organizing systems. However, lots of virtual communities of practice are lifeless because they fail not only to attract enough par-

ticipants, but also fail to supply enough supports. Communities need to invite the interaction that makes them alive (Wenger et al., 2002).

Appropriate management can seed and nurture the communities of practice (Wenger 1998b). Some supports for the aliveness of the communities of practice are:

- Providing experts to support distributing quality information.
- Providing moderators to respond timely to participants—a quick response tells participants that there is always somebody care for them.

Wenger also state (Wenger et al., 2002)

- Allowing for people participating in the discussions.
- Having one-to-one conversation.
- Providing both public and private community spaces.

2.2. Social navigation

2.2.1. Definition

The concept of social navigation was introduced by Dourish and Chalmers (Dourish and Chalmers 1994): “*navigation towards a cluster of people or navigation because other people have looked at something*”.

The more concrete explanation of social navigation is: When navigating, people are guided and informed by others and their actions:

1. Talking to others and seeing their performance. For example asking people where the cinema is, or inferring this knowledge from perception (when many people gather before a particular public building, this building might be the cinema).
2. Seeing the aggregated users’ activities they performed. For example in a library, knowing a book is popular because it is well-worn, or, the recommended URLs list offered in web pages.

Social navigation is very common in the real environment because people typically pay a lot of attention to the behavior of others and influenced by their activities (Dourish and Chalmers 1994).

The aim of social navigation of the system is to exploit the behaviors of others for supporting users in navigating the information space. However, it should be addressed that the social navigation information about others are doing or did only can guide and influence, but not control people’s action and decision (Dieberger et al., 2000). Additionally, as the community system, people would like to be aware of other community members especially when they know each other. The social navigation can enhance social awareness and encourage their participation to the community.

The social navigation can be direct and indirect, intended and unintended which will be elaborated more in detail later in the following sections.

2.2.2. Social navigation and general navigation

When navigating socially, people take advantage of others and others' actions to guide themselves to find their directions. The difference of social navigation from general navigation can be clarified with two examples:

1. When looking for a certain street, one chooses asking for a policeman and another uses a map. The first person uses social navigation because he got help from a person and the second one doesn't.
2. Following the footprints in the snow to get somewhere is social navigation, while walking along the street is not. People are guided by the footprints left by others, which existence depends on whether it is continually used or not. The street itself is an intrinsic part of the space and there is no relationship with people and their actions.

The two examples indicate the two phenomena in the social navigation: personalization and dynamism (Dieberger et al., 2000). Navigating socially does not mean navigation more efficient than the general navigation.

2.2.3. Social navigation in real world and virtual place

In the real world, the communication between a navigator and a advisor usually has to be done synchronously, while it can be done often asynchronously in the virtual place. As an example, the response to a question posted on the bulletin board can come one day later.

In the physical world, architecture and spatial design have a strong influence on how people navigate. For example, a passenger gets help from policeman to get to the cinema: "Go straight and make a right turn at the third corner". Or, the passenger relies on the indirect social cues "There are a lot of passengers toward that building, it must be a cinema". The structure in the virtual information space is different from physical world. The social cues are used to present the other's action in the virtual place and are mediated in different ways. However, the experience from the navigation in the real space could be used to direct the users. For example, an image of the footprints in the snow can be used as a social cue about how frequently and how recently the web page has been visited.

2.2.4. Forms of social navigation:

Social navigation can happen in many different forms, ranging from following a group of people that they do not know, to approaching an expert in the field asking for advice on how to find information.

Direct and indirect

Social navigation can be distinguished between "direct" and "indirect" (Dieberger et al., 2001). In direct social navigation, people engage the communication to give

advices and guide each other. The communication between people can be both synchronous and asynchronous, for example in a chat room and or on a bulletin board.

In indirect social navigation, people use navigation cues to be aware of other people's actions or see the traces of where people have gone through the space. These navigational cues are the aggregations of the behaviors performed by entire users. Therefore they can provide certain overview of the information space. An example of the indirect social navigation can be found in the EDUCO (Kurhila et al., 2002), in which the colored document icons indicate the amount of the reading activity of the document from entire readers.

The use of direct or indirect social navigation is determined by the needs of the users. People may like to share information in the public without disturbing others. However, if an information seeker needs help under time pressure, therefore, directly asking somebody may be a more efficient way.

Intended and unintended

As we discussed above, the difference between direct and indirect social navigations is from *the information seeker point of view*. From the *information giver point of view*, there are intended and unintended social navigations. In the physical world, an example of intended social navigation would be when people recommend someone a place to visit, while the footprints on the snow can be unintended navigation. In the virtual world, the unintended social navigation can be one leaves traces, or hints, to other users without doing this as a conscious activity (Forsberg 1998). An example of the unintended social navigation is the footprints system which leaves information behind unintentionally (Wexelblat and Maes 1999).

2.2.5. Types of social navigation

Besides of the different forms of social navigation, the types of the social navigation can also be distinguished based on the different navigation tools.

History enriched environments

History enriched environments are navigation environments that preserve and integrate interaction history and display it to the users. The users can use this history to guide themselves navigating in the information space. History enriched environment may help people find relevant information

CoWeb

One example of history enriched environment is CoWeb, a collaborative Web space implemented by Mark Guzdial (Guzdial 2001). The detailed information about CoWeb is described in chapter 5. The original CoWeb has two social navigation tools: one is "Recent Changes" which aggregates the most recently changed pages. People can see what pages are modified recently; another is "View other Revisions" which preserve the different versions of the pages. People can trace the history of the pages.

Read-wear

Read-wear is another type of history enriched social navigation which aggregates activities on a certain object from users. People then can see how an object has been used (e.g. access, read, download and etc.) by other users.

Andreas Dieberger developed other two social navigation tools in CoWeb with read-wear feature (Dieberger 2000a); one is the small footprint symbols with three different colors which integrate the access history. People can see the amount of traffic behind a page. Another is the little “new” icons with three different color which calculate the newly accesses. People can see the freshness of a page.

DEUCO

Another example can be found in a student-centered learning system, (Kuruhila et al., 2002). It visualizes the document space. In the document space, the read-wear is aggregated based on the amount of readers and shown by using colored documents icons. It can help users follow the footsteps of the others.

Recommender systems

Recommender systems can also be considered as another type of history enriched social navigation which based on the other people activities. It helps people make decision and selection by looking at what other people have done.

Rating and commenting are common and simple methods of a recommender system. Amazon.com accumulates purchasing activity and gives recommendation like “people who bought this book also bought...”

Synchronous communication in information space

This kind of social navigation system puts emphasis on real-time communication. It can be also found in EDUCO. The online users are presented in the document space by using moving dots. It indicates that they are currently viewing a document and roughly how many they are. The synchronous communication can be perform by clicking the dots representing the users.

However, social navigation is more a border concept than a history enriched system or a recommender system. It is not a system but a way of consideration when designing information systems (Dieberger 1997, Munro et al., 1999).

Putting the forms and the type of the social navigation together, different systems can be classified in the following table:

	Intentional	Unintentional
Direct	Synchronous / Asynchronous communication	
Indirect	Recommender systems	History enriched environments

2.3. Social navigation in virtual community of practice

It is important to elicit the relationship between social navigation and a virtual community of practice when defining which of the social navigation approaches should be used, especially in the situation that the requirements of the community of practice are not clearly defined..

Which kinds of social navigation should be used depend very much on the structure of the community of (Robins 2002). A community of practice as a virtual place can be made up by different communication tools, such as bulletin boards, chat rooms, and email lists. These can offer opportunities for forming different types of social navigation approaches.

The activities that people are performing or performed in the community of practice are the basic sources for indirect social navigation. The activities that people can or cannot perform rely on the structure of the community of practice. In the Amazon web site, the structure support people to buy books and add reviews on-line, therefore it is possible to use the information of “people bought this book also bought those books” and “the review of the books from buyers” as social navigation approaches. In EDUCO system, the document space can support people view the certain documents and record who they are and which documents they are reading, therefore the readware of a document shown to the others function as an indirect social navigation approach.

As mentioned previously, social navigation may also help the users navigate to important information and have a better overview of the space (Dieberger et al., 2000). But not only helping the users perform their tasks, social navigation can also increase the people’s social feeling in the community of practice and therefore attract and encourage people to participate the community of practice.

The benefits of social navigation can be concluded as three aspects:

1. Guide users to find relevant and important information;
2. Help users make decisions and selections;
3. Enhance social awareness and increase the willingness to participate.

So far we may summarize that the social navigation is neither a standalone system nor solely a tool, but a design approach in designing the virtual community of practice to either enhance the sociability or help information navigation. And vice versa, the more sociable virtual environment will provide more chance for social navigation.

2.4. Getting started

Based on understanding the relationship between the social navigation and the virtual community of practice from the above literature study, we cannot peel the social navigation from a certain virtual community of practice and only define the requirements of social navigation. Instead, an integrated approach should be used and the social navigation requirements have to be defined in the context of the given virtual

community of practice. So without any escape, we first have a closer look at the target virtual community of practice.

The features of the communities of practice are based on the needs of the members and the life of the communities of practice is depended on the member's participation. However, weather or not the members will participate in a community depends on what they can benefit from the participation. Therefore the user requirement generation will start from and focus on the benefits that system should provide to satisfy the user's needs. In the next chapters we will show that the requirements were gained through different approaches in our project.

3. TARGET USER GROUP

A requirement definition cannot be done without knowing the target user group. Who are these new teachers? What are their backgrounds? Are they familiar and comfortable with technologies such as computers and the Web?

After the basic understanding of social navigation and communities of practice, we are now ready to find out what our target users would think about the idea. Are they experienced with the virtual community of practice and what would they like to benefit from the new system?

In an idea situation, the experienced users would tell what they want from the new system, and even more, how they would like to take advantage of the social navigation. With some editing and binding, we will immediately get a look of the preliminary requirements and conclude this project.

The question is, are they experienced?

3.1. Procedure

We first interviewed the project owners in order to find out what the target system is intended for. From the interview, it is clear who our target users are. They are new teachers from the primary and secondary Dutch schools and they want to make teaching a career. But they are not qualified yet. We want to develop a system of virtual community of practice so that they can help each other and get help from experienced teachers and others involved. Social navigation was thought a good way to give them feeling of socially connected and hence to attract them to participate.

In order to know our users better, we then developed a questionnaire. Since the users are spread all over the Netherlands and hard to reach, we launched the questionnaire online. The link to the questionnaire was send to all thirteen new teachers that were available in the project owner's contact list. The questionnaire was in Dutch (see Appendix A).

Thirteen were invited, only six responded (see Appendix B). Despite the low response, we still got a global idea about the user profile. Afterwards we also interviewed a project moderator who has many contacts with end users and know the new teachers very well. The interview confirmed the findings from the six responses.

3.2. User profile

3.2.1. General information

The target users are currently new teachers in primary or secondary school in the Netherlands. They are Dutch citizens and communicate in Dutch. They are between 20 and 35 years old. The distribution of the teachers is all over the Netherlands.

Although they have required domain specific background, such as mathematics and physics, they are different from other teachers because they don't have the certificate as a qualified teacher should. The reason of involve them in teaching is the shortage of primary or secondary school teachers.

Before they became a teacher, most of them had a different job, some were students, and some were unemployment. Most of them did not have any teaching experience, such as didactic skills. They have to go to training centers one or two days a week, to learn theories, consult their mentors, and exchange ideas and experiences with other teachers.

3.2.2. Computer skills

They use computers for 2-4 hours a day at school or at home for writing, emailing and online banking. Some of them also have some experience with e-learning software, online forums and instant messaging with friends.

Most often used software packages are Microsoft Word for writing and Microsoft Outlook for personal information management and emailing. Less used software or online services are Microsoft Excel and Hotmail. Few used Macromedia Dreamweaver to make web pages. It is surprising that only few of them used instant messaging software such as MSN messenger, and few had experience with e-learning systems.

Their computer skills and the usage are found to be very limited.

3.2.3. Communication

Face to face conversations

During the working day at the primary or secondary school, they consult other qualified teachers. They exchange information in the training centers with other teachers and consult their mentors. However, they complained that they could not have smooth and efficient discussions all together face to face because of age gaps between them.

Phone and email

They also communicate with others over the phone or using email. Emailing is found to be the least used means for communication.

Motivation for communication

Teaching is new to them and most of them never learned how to teach. It is a challenge and they often encounter a lot of practical problems and they want to solve these problems in one way or another.

- They are strongly motivated to exchange information with other new teachers
- They want to consult experienced teachers for didactic methods.
- They want get just-in-time and hands-on help from experienced teachers.

3.3. Requirements according to the user profile

The user profile leads to some basic requirements:

- Users share information with other students and their mentors mostly by face to face contact and conversation, telephone, email. The information can be shared and exchanged varies from some ideas and opinions to experiences and knowledge. The information can be in a form of a short message, an article, or an illustrating picture. The future system should provide a virtual place for the users to carry this kind of information sharing and exchanging any type of information, along with the email, online chatting functions.
- Most of users only have few contacts with others after work. The future system will provide a virtual social place to gather them together to extend their social contacts, not only to provide peer to peer communication, but also to share information among them.
- The most users are familiar with Microsoft Word and Microsoft Outlook. A user interface that is similar to Microsoft Office packages would make them more comfortable and decreases the learning load.
- The users have intensive teaching tasks and their time for using a computer is limited, so the system should be attractive and encouraging enough for the users to remain in and contribute to the system.
- Their computer skills are limited. So the system should not be too complicated with too many functions. The functions should be well structured and easily accessible from the interface.

Using the benefits from the literate study as the checking list (cf. see section 2.1.2), the benefits the end users are most wanted are ticked in the table:

Providing an efficient idea exchange	√
Providing high quality content	√
Helping for problem solving	√
Helping people do their jobs	√
Helping develop individual skills and competencies	√
Providing greater access to experts	√
Increasing members' motivation to learn	
Providing challenges and opportunities to contribute	
Developing professional relationship	

3.4. Discussion

The validity of user requirement gathered via this user study is low. There are two reasons. One is that the online survey could not get enough responses to catch more accurate and explicit needs from the end users. Another is that the virtual community of practice is new to the target user group it is difficult for them to imagine what they can do and tell how they would like to do it. The virtual community of practice is quite different from what they do in real social environment. Although we can learn things from their social behaviors and requirements in their current community, these behaviors and requirements can change when they enter the virtual community.

We are facing inexperienced users and a new concept for them. To compensate, we will turn our eyes on an ongoing virtual community of practice in next chapter to observe and study how a similar and experienced user group behaves.

4. TEACHER FOCUS: AN ONGOING ONLINE COMMUNITY

Since our target user group is not experienced with the idea of virtual communities of practice, we decided to have a closer look at a similar user group of an ongoing online community called “Teacher Focus”. They are similar not only because both are teachers, but “Teacher Focus” also tries to involve new teachers in a dedicated space. By August 11, 2004, they have 2492 registered users and 5863 posted articles. This enables us to observe a much bigger group of users, about their behaviors and the content of the postings.

It is a running system, which also gives us opportunity to get our hands on the social navigation part of the system: what kind of social navigation has been used and what are the users’ opinions about it? What does it suggest for our future system?

4.1. “Teacher Focus” community

A screenshot of the “Teacher Focus” online community (www.teacherfocus.com) is shown in Figure 1.

“Teacher Focus” is an online community service mainly for the teachers to share information and have discussions among them. Forums are the major parts of the service which are categorized into nine topics, such as New Teachers’ Place and Educational Technology. As a registered user, one can initiate a topic by posting an article and add a poll to this article. The user can also reply to other’s post with or without quoting the original post. As a guest, the user can only view the content of the forums.

There are moderators who are involved in each forum to manage the topics and posts. In addition to what a registered user can do, they can also remove topics and posts. Moderators are responsible for directing people to post in the right categories.

The forum also provides some other information to the users:

- Number of registered and their online status.
- Number of online guests.
- Number of hidden users. Hidden users are those who are registered and currently online, but they can hide their online status from everyone but the administrators.
- For each topic, it provides information about the author, the number of views , the number of replies, and the time and the author of the last reply.

- Animated icons are used to indicate the popularity, whether it is a new topic, and whether it has been locked by the moderators.
- For each post, it shows the author of the post and some information about this author, e.g. joined time, the number of total posts by this author, personal interests and contacts.

The forum New Teacher's Place is the most popular forum besides the "Teacher's Lounge". The users of this forum have the similar user profile to our target users. The forum has the same goal with our future system, that is, to look for help and advices, and to share teaching experiences. The new teachers can also use other forums, such as "Elementary and Early Childhood Education", for a particular topic, but the "New

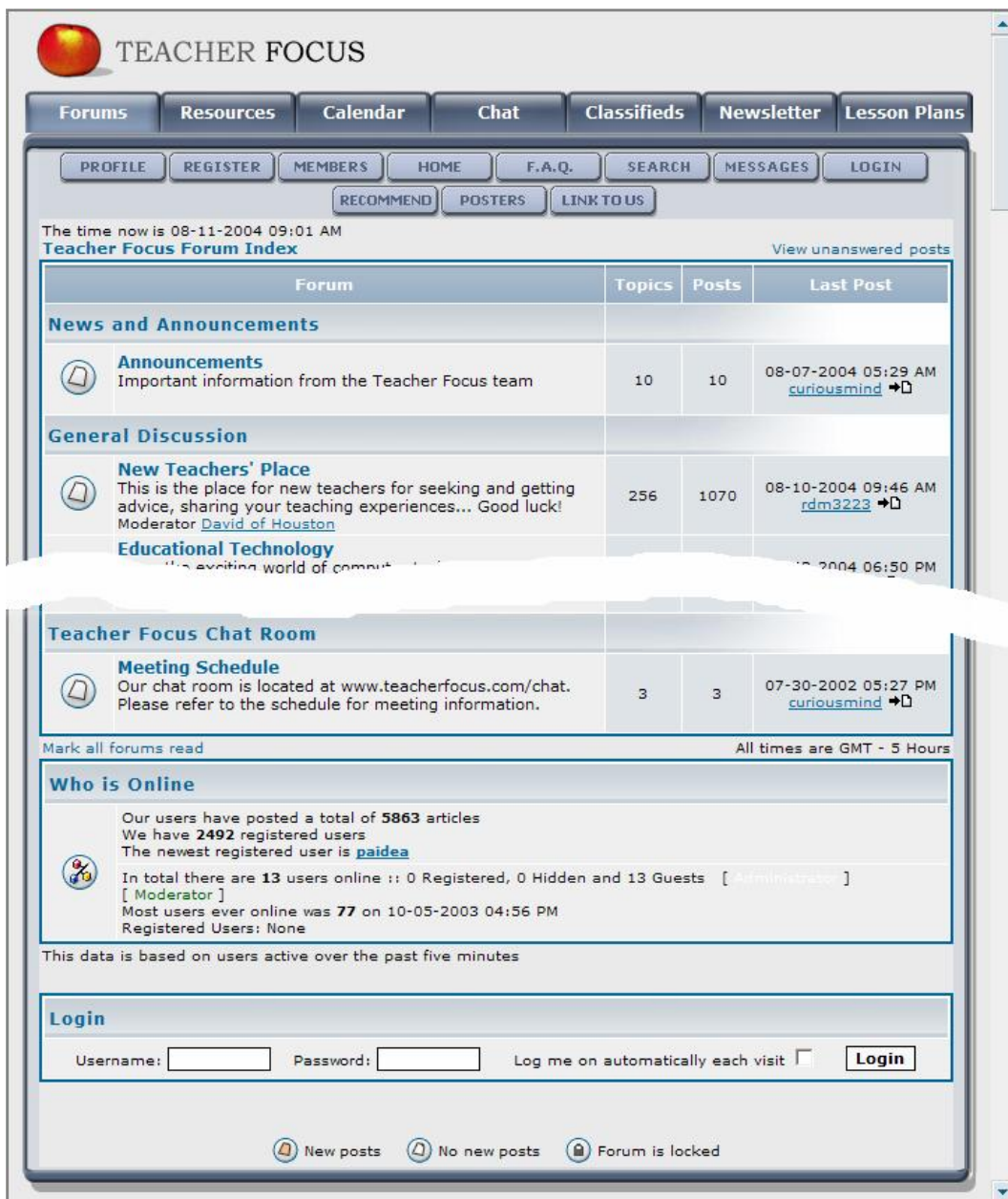


Figure 1. Screen shot of www.teacherfocus.com

Teacher's Place" is more interesting for us to have a closer look.

4.2. Observations

We observed the "New Teachers' Place" in detail, and then all forums in general. We try to define the user groups of these forums. Some statistical information gives us some ideas about the distribution of the users, their posts and therefore their interests. Based on the observation, a typical use scenario is developed to show generally what a new teacher is getting involved in the forum and how social navigation could help her out in particular situations.

4.2.1. User groups

There are mainly three user groups:

Administrator and Moderators

They manage and moderate the forums. They

- Motivate users to contribute to the forums and direct them to post in the right categories;
- Join the asynchronous conversations by replying to other posts;
- Manage the threads and posts, including creating new threads, removing and locking threads, and removing other user's posts.
- Invite other users to be a moderator or an administrator to help to manage the forums.
- Remove users from the registration if necessary.

Experienced teachers

They have been working as teachers for years. They want to share ideas and experience, ask for suggestions for specific educational cases. They

- Create new threads by post new topics;
- Join the asynchronous conversations by replying to other posts.

New teachers

They don't have much practical or theoretical experience on teaching. They do not only want to gain more teaching experience by asking questions for answers and advice, but also want to get encouraged since they encounter so much troubles and frustrations. They:

- Create new threads by post new topics in the "New Teacher's Place" forum;
- Join the asynchronous conversation by replying to other posts.

4.2.2. Statistical Information

Forums in total

There were about 2492 registered users and they posted a total of 5863 articles by August 11, 2004. The registered users also include ten moderators and one adminis-

trator who post 38 percent of articles. The following table shows the percentage of registered users who contributed certain number of posts.

Number of posts	11 or more	6-10	2-5	1	0
Percentage of registered users	2.5%	1.8%	12.7%	20%	63%

New Teachers' Place

We decided to analyze the users who posted to this forum during May 2002 and May 2003. The reason for choosing this duration was that it was the most active period. Most of the users posted more than one post. The rate of reply (84%) during this period was higher than average (75%) in this forum.

There were 55 users posted 82 articles. 10% of the articles were posted by moderators and the administrator. 80% of the posts were questions. 84% of the posts had replies and there were 187 replies, in which 60% were replied by the moderators. 60% of the question posts got no reply. There were about 4000 views in total. During this one year period, 80% of users posted just once or twice, only 10% of the users posted more than ten times.

In general, comparing to the average of all the forums, users in this forum were much more active, especially in asking questions and joining in discussions.

4.2.3. A use scenario

In order to develop a use scenario, four users are chosen as the observation objects. They are

New teachers:

Name	Joined time	Total posts	Teaching field
Jeanne	22 Jan 2002	41	Elementary school teacher
Jonathan	24 Jan 2002	10	Arts

Experienced teachers:

Name	Joined time	Total posts	Professional field
Grace	27 Jan 2002	37	Spelling
Sherid	07 Jan 2002	70	high school English and writing

Through the observation, a scenario was developed as below:

Jeanne had been an attorney for 15 years. She was going to teach in an elementary school in one month. It was a major career change for her. She happened to find this site, and found there was some useful information and planned to visit these forums often. After a few days "lurking" in these forums, she posted her first article to introduce herself to two different forums in order to get some advice for preparing her new career. After a few days she got replies from a moderator of one of the two forums.

The moderator encouraged her that there was nothing to worry about and recommended a very nice book for her to read. The moderator also told her his ex-

periences. Later two experienced teachers, Grace and Sherid, also joined in the conversation and gave her encouragement and suggestions. She replied them and felt very much involved in the forums.

Jeanne looked through the “New Teachers’ Place” and an article posted by moderator was found to be very helpful. The topic was about classroom management. There were several users (mainly experienced teachers and moderators) joined the discussion. She got some different ideas from the discussion and did not know which one was the best solution. Still, Jeanne thought this thread was wonderful and even printed all the posts out. She also replied to show her appreciation to everybody in this thread.

After visiting and participating, she had built up a kind of friendship with Grace and Sherid. The conversions among them became more flexible and enjoyable. She also got to know more about the other users whom she often “talked” to.

She found a new thread which was about an interesting issue in the elementary schools, but there were some points that she was confused with. She posted a question about these points. A few days later Jonathan, also a new teacher, replied and asked for her email address in order to provide more detailed information. Jonathan had started his new job for some time and he had a collection of materials about the issue. They exchanged some opinions via email afterwards. Some of the materials were thought to be very helpful to other new teachers. Agreed by Jonathan, she posted these materials to the New Teacher’s Place and wrote an introduction.

Some time later, she went back to this site and found there was a new post in the Education Technology category. The thread was initiated by the administrator. She opened the post and found there were a lot of replies on this topic already. She read through them and found that she could not agree with some posts according to what she just learned from Jonathan’s material. She added her own opinion.

“Tomorrow it was the day. I am now ready to meet my students.” She posted to the New Teacher’s Place, ended her sentence with three smilies ☺ ☺ ☺.

4.3. Findings

There were mainly nine findings according to the observation.

1. There are more dead communities of practice than active ones on the Internet.

It took quite some time to find a successful and flourish online community of practice. Although there are a lot of online communities, they are just almost dead. Either they don’t have enough participants, or there is nobody willing to reply. Many online community services exhibit a difficult interface, especially for new users. A new user often has to go through difficult registration and verification process in order to get access to some part of the service or to post the very first post. Every web-based community has its own style of posting and editing.

2. Moderators’ supports play an important role.

The role of a moderator is designed for making and maintaining the rules, checking and managing the content. But the moderators are there not only to be a policeman. They are more than ordinary users because they are supposed to spend more time on the forums, to know more about their forums, and sometimes, to have a background of related topics. They are the ones to show the hospitality of their forums to new comers by leading them around, and respond to the posts by new comers if there is no one doing so.

The New Teacher's Place had such a moderator, who kept catering the forum and the new teacher felt welcome.

3. The articles with valuable information from the moderators and experienced enrich the content of the forums and make these forums worthwhile to visit.

Most of the users post less than two times. For those users, they register because they want to post or reply once or twice, but most of the time they just "lurking" around to find valuable information. If they could not find anything useful, they will turn away and might never come back. Most of "lurking" users do not contribute - only 5 percent of registered users who contribute more than 5 articles with valuable information. This amount of contribution cannot keep the forum going briskly.

In "Teacher Focus", the moderators and experience teachers often post articles not to ask for help or advice, but to share knowledge and information that they think would be helpful and valuable for the others. This makes the forums worthwhile to visit, even only to "lurk" around. Often new comers hesitates to contribute, keeping them "lurking" around is a way to turn them into potential contributors.

4. The new teachers appreciate the help and advice by the experienced teachers.

Answering questions, giving advice and instructions, providing useful practical cases, the experienced teachers turn the forums a valuable and useful resource for the new teachers. Well categorized resources by experienced teachers, such as links to useful websites, books, and software tools are found to be helpful for the new teachers. As users said: *"The people here are incredibly helpful and knowledgeable, and this is the first place I come with questions"* , *"places like this are great for fostering the kinds of discussions you would have in grad school, as well as for providing reality checks from working teachers"*.

5. The asynchronous conversations are often person to person

In the conversation, the users post to reply a certain user by mentioning the name or referring to the original post, sometimes even as if they are emailing to each other. The asynchronous conversation then turns into a relay chat. The users get to know each other; they make jokes in a good humor. The conversations become more friendly and enjoyable.

6. "Lurking" is an important way of participation.

There are always more "lurking" viewers than posters. People come to a forum more for finding things than for sharing. They register and post to the forum only

when it is necessary. During a five-day observation, whenever we visited the “Teacher Focus”, there were always more guests than registered users.

“Lurking” is found to be an important way of participation. “Lurking around” allows them to take their time to read and think, not to annoy others by rashly posting things that are unrelated, asking questions that has been asked and answered. For a forum, it may not be as important as posting, but for a user, this "lurking" gives a sense of what participants in a forum expect to learn from the community, how they interact with each other and how one can add value to their conversations.

“Lurk before you leap” is often the first advice given to the new comers in an online community.

7. Most of users post because they want answers to their questions.

The users of the “Teacher Focus” come mainly for solving their problems. The problems range from the personal concern of teaching as a career to practical educational issues. Among these problems, examples are:

- Should I become a teacher?
- How can I teach without giving students homework?
- Classroom discipline and appropriate consequences

8. Reply to a post is rarely immediate. It often comes a few hours, a few days or even a few months after.

The late reply is mostly posted by the newly registered users. It indicates that the new comers browsed through the archives of the forums before posing.

9. More replies often means more hits (views).

Number of replies is a typical social navigations cue, which indicates the group interest in the topic. It leads to more hits, which shows that people do use this social navigation cue, in purpose or unconsciously.

4.4. Social navigation in “Teacher Focus”

Forums are social spaces where people get together discussing about certain topics. Topics are organized as threads. As there are human activates, there must be some social cues and traces that could be used for social navigation, to guide the users through to find the information they want. “Teacher Focus” uses some of social navigation methods we mentioned in previous chapter:

4.4.1. History enriched environment

In the thread list of a forum, it shows the author of the original post, number of the replies and views, creation date of the first post and the last reply as well as the author of the last reply. People may be guided by these data, for example,

- They might know the authors and always be interested in their posts;

-
- The number of the replies and the views shows the popularity of a certain topic. The number of the replies indicates how many people have actively joined the discussion, whereas higher number of views indicates more people thought it was an interesting topic.

4.4.2. Intended social navigation

In the forums, people post questions to ask for help. Often, somebody replies and tells that it is not the right place to post such a question, or there was already an answer or a solution elsewhere. Together with it, people often redirect the discussion to another forum, thread or post with a link. Sometimes, the users are asked to read certain instruction articles so that they can post their questions in a right place and in a right way, which is a typical kind of intended but indirect social navigation.

4.5. User requirement analysis

Based on the above observation, we are now ready to generate the requirements for our target system. This is done by looking at the benefits that the teachers, especially the new teachers can get from the “Teacher Focus”, also the existing features and functions that the users find to be useful or helpful.

4.5.1. Benefits

The users can to some extent get all the benefits listed in section 2.1.2 from the “Teacher Focus”. Comparing to the results found in the target user study (cf. section 3.3), the last three left-out benefits are now found to be worthwhile to be covered in our further system.

Providing an efficient idea exchange	√
Providing high quality content	√
Helping for problem solving	√
Helping people do their jobs	√
Helping develop individual skills and competencies	√
Providing greater access to experts	√
Increasing members’ knowledge	√
Increasing members’ motivation to learn	√
Providing challenges and opportunities to contribute	√
Developing professional relationship	√

In the “New teacher’s Place”, the large amount of existing and well organized articles interested and motivated the new teachers to read, think and finally to exchange and contribute. The encouragement from the moderators and the experienced teachers also helped a lot.

In the “New Teacher’s Place”, the new teachers are also challenged by the questions from the others. We found that not only the experienced teachers, but also the new teachers were actively trying to answer these questions. It indicates that the new teachers could handle the challenge very well.

The new teachers can also build up and expand their professional relationship as we found in the “New Teacher’s Place”. This is a natural result once the new teachers start to participate. We think this is rather what a community can provide than what a system can do. What a system could do is to facilitate this process of building up and expanding the relationship, that is, to provide contacts and means of communication.

Our target users could not foresee these features without actually experiencing a virtual community such as the “Teacher Focus” and this explains why these features were not “wanted” in the next chapter.

4.5.2. Other requirements

Not only new teachers, but also experts and experienced teachers should be involved.

Most of new teachers came to the forums for solving their problems and looking for help. They are information seekers. They are interested in the places that are full of useful information and helpful hands. Before any new teachers start to contribute, they have to be convinced that this is the right place to do so. So the further system could not start from an empty skeleton. Experts and experienced teachers should be involved right from the beginning to make the place ready for the new teachers to “lurking around”.

The experts and experienced teachers should also stay in the community to provide well organized and useful information, solving problems and sharing practical experience, so that the new teachers can benefit more than only new teachers involved.

So the target system, should not only focus on the new teachers, but also involve and attract experts and experienced teachers. As the new teachers grow and they become experienced, the system should try to keep them stay in the virtual community.

Asynchronous conversations are enjoyable, but the system should provide private spaces for such conversations so that only useful information remains in public.

As the new teachers participate, they start to develop their own personal contacts with people in the virtual community. People tend to have private person to person conversations even when it is asynchronous. In a forum, this is often done through normal posts and replies as we observed in “Teacher focus”. The “Teacher focus” does not provide private spaces for such person to person chatting. Such conversations are found to be enjoyable for the users involved, but at the same time, to be annoying for other users because often these conversations are full of gossip and jokes. Dedicated private “rooms” would solve the problems, and only useful articles and discussions should be posted to the public area.

Social navigation

The social navigation cues found in the “Teacher Focus” should be kept for our purpose, such as number of the replies, number of the hits, the time and the author of the first and the last post.

Intended social navigation should be encouraged in the future system. We may think of a special area for people to write about navigation instructions – in forums this is often been done by locking these articles on the top of the list.

People also would to know what their friends are currently doing. Sometimes they like to follow what the others are doing. A list of online friends and their current activities would increase the feeling of social involvement. However a user’s online activity should be shown to friends or other people only when the user is willing to do so.

What is missing but could be a nice feature in “Teacher Focus” is whether the friends of the user has read or replied a certain thread, how many of them and who are they. It would help a lot if a list of such pops up on each thread when the user moves the cursor over it.

4.6. Discussion

The validity of user requirement gathered by observing the similar user group in the ongoing community is higher than what we have got in the previous chapter. There are three reasons. First, we were observing the users that have already some experience with virtual communities of practice, so we could observe their online behaviors instead of asking our target user group to look into the air and daydream what and how they would do. Second, the existing content of the online community give us opportunity to analyze how a new teacher could benefit from others, especially the experts and the experienced teachers. Third, it also enable us to do some quantitative and thus more objective analysis, such as how many users stay lurking, how many of them contribute and how much they contribute. The findings and the requirements are hence more down to earth.

However in this chapter we only looked at one of the online forums. There are more types of virtual communities than just forums. In the next chapter, we will study three different online communities in order to get a bird’s eye view.

5. COMPARING THREE ONLINE COMMUNITY SYSTEMS

The “Teacher Focus” community had given us a chance to get some insights of the users, their needs and their online behaviors. But it was just a forum-based online community and there are more other types than just forums. To get to know more about how online communities can be structured and how social navigation could help the users to locate the information, we will study other three virtual communities of practice in this chapter: CoWebs, weblogs, and the Usenet.

5.1. CoWeb

A CoWeb is a collaborative hypertext environment which is based on WikiWikiWeb (Guzdial 2001); anybody can create or edit the pages; pages are linked by their names. There is no need to use HTML. Users can format their pages using a much simpler marking up language. The simplicity of the syntax also leads to simpler layout and unified look and feel.

Some recent WikiWikiWeb engines use a different method: they provide “WYSIWYG” editing, usually by means of an ActiveX control or plugin that translates graphically entered formatting instructions such as “bold” and “italics” into the corresponding HTML or Wiki tags. The user is shielded from the technical detail as the markup is generated transparently.

A CoWeb is to support collaborative writing and to open discussions. From management point of view, most of CoWebs are self-evolving and self-maintained. CoWeb can support authorization to protect pages from the abuse. However, it is approved that there is hardly any inappropriate posting. People are given rights to create, edit and remove pages; it is just too easy to mess it up and hence there is no challenge whatsoever to hack around; messing around only proves one’s insanity and nothing more. Everybody who uses CoWeb feels responsible to keep the CoWeb clean.

The original CoWeb has mainly two social navigation tools: one is “RecentChanges” which aggregates the most recently changed pages. People can see what pages are modified recently; another is “View other Revisions” which preserve the different versions of the pages. People can trace the history of the pages.

Andreas Dieberger developed other two social navigation tools in CoWeb with the read-wear feature (Dieberger 2000a). One is the small footprint symbols with three different colors which integrate the access history. People can see the amount of the traffic behind a page. Another is the little “new” icons with three different colors which represents the freshness of a page.

5.2. Weblog

A weblog, or simply a blog, is a website which contains periodic, reverse chronologically ordered posts on a common webpage. Such a web site would typically be accessible to any Internet user. Individual posts either share a particular theme, or a single or small group of authors. The format of weblogs varies, from simple bullet lists of hyperlinks, to article summaries with user-provided comments and ratings. Individual weblog entries are almost always date and time-stamped, with the newest post at the top of the page. Because links are so important to weblogs, most blogs have a way of archiving older entries and generating a static address for individual entries.

Two features which are common to blogging are "blogrolls" and "commenting" or "feedback". A blogroll is a list of other blogs that are linked to separately from any article. This is one means by which a blogger creates a context for his blog, by listing other blogs that are similar to his own. This is a typical cue of intended social navigation. It is also used as measure of the number of citations a blog has, and is used to rank "blog authority" in a manner similar to the way that Google uses hard coded html linking to create "page rank". This information could also be used by a user as a social navigation cue.

Another central, and sometimes controversial, aspect of blogging is the use of a feedback comment systems. A comment system allows users to post their own comments on an article or "thread". Some blogs do not have comments, or have a closed commenting system which requires approval from those running the blog. For other loggers, comments are the crucial feature which distinguishes a "true" blog from other kinds of blogs. If a blog has regular comments, this is referred to as the blog's *community*.

Such a writing-commenting mechanism could be welcome in a collaborative environment when the author of the original post does not want any others to change the article but only want others to discuss about it.

5.3. Usenet

The Usenet is one of the oldest computer network communications systems still in widespread use. It was well before the popularization of the Internet and well before the World Wide Web. Today, almost all Usenet traffic is carried over the Internet. The format and transmission of Usenet articles is very similar to that of Internet email messages. However, whereas email is usually used for one-to-one communication, Usenet is a many-to-many medium.

It consists of a set of "newsgroups" with names that are classified hierarchically by subjects. It is completely decentralized by categories, then interest groups, then a specific topic or subject area. The main utility of the newsgroup is to create a discussion thread. From management perspective, newsgroup is open to a variety of users. It does not require user registration. Some newsgroups are "moderated", where the articles are first sent to a moderator for approval before appearing in the newsgroup.

Newsgroups are perceived as virtual communities because the feeling of “belong together”, shared information, group-specific attitude and the dynamics of mass interaction. Newsgroups can also be considered as the virtual place where people exchange ideas, discuss, communicate and even make friends (Roberts 1998).

Some point out that some newsgroups are helpful in their own way because of the resources of a variety of participants. For reasons which some may not be able to understand, many participants are willing to answer questions on subjects ranging from software troubleshooting, and other technical issues, to such topics as pros and cons of different medical treatments for a rare disease.

Virtually all messages posted to the Usenet system are archived and made available in publicly-searchable databases on the World Wide Web. This allows for a great depth of historical records of news, information, and of the behavior of individuals who choose to attach their real name to messages.

A typical social navigation cue in newsgroups is the FAQ’s (Frequently Asked Questions). If there are so many people keep asking the same question, the question together with the answers are archived and categorized into the FAQ area. This is typical intended and indirect social navigation.

5.4. Discussion

5.4.1. Benefits comparison

The above three systems have similar yet different usages on information sharing. CoWebs focus on the collaborative editing and information sources collecting; newsgroups focus on asynchronous discussion; weblogs focus on information distributing and feedback gathering.

Again we use the benefits checking list (cf. see section 2.1.2) to find out which benefit can be supported better in the community of practice. The comparison is made the in table below.

	CoWeb	weblog	Usenet
1. Providing an efficient idea exchange	√√	√	√
2. Providing high quality content	√	√	√
3. Helping for problem solving	√	√√	√√
4. Helping people do their jobs	√√	√	√√
5. Helping develop individual skills and competencies	√√	√	√
6. Providing greater access to experts	√	√	√√
7. Increasing members’ motivation to learn	√	√	√
8. Providing challenges and opportunities to contribute	√√	√	√
9. Developing professional relationship	√	√	√√

A CoWeb seems to be helpful for developing the member’s knowledge and individual skills, because it can provide information resources in a more collaborative and

structured way. The open way of page creation and editing may also provide challenges and opportunities for the users to contribute.

The Usenet allows open discussions and the users often post their questions and ask for help. It has a larger coverage of the experts that are willing to answer these questions. Comparing to the CoWeb, It is harder to find information in the archives. Often the only way to do it, besides read the FAQ, is to use text based search engine.

Reading a weblog might be a good way of solving problems if the weblog is about a particular topic, provided that people know where to find such a weblog at the first place. Many weblogs are there only for publishing, and not open for discussion and commenting. There is no community around such weblogs and hence they are out of our concern.

5.4.2. Social navigation

The comparison below is based on the existing social navigation as we discussed above. There are more social navigation approaches in CoWebs and the Usenet may help the users to find relevant and important information than in weblogs. However, we have to be aware that there are a lot of different implementations of each of them. The number of social navigation approaches largely depends on the implementation, which make this comparison skip deep and unreliable.

	CoWeb	Weblog	Usenet
1. Guide users to find relevant and important information	√√	√	√√
2. Help users make decision and selection	√	√	√
3. Enhance social awareness and increase the willingness to participant.	√	√	√

The three compared systems have both advantages and disadvantages. It seems that the CoWebs/WikiWikiWebs are closer to what we wanted, but we may think of adding some nice features from the weblogs and the Usenet to make our target system richer.

In next chapter take these concerns into a modified CoWeb, in order to get more feedback from a committee of experts and those who know the end users.

6. MODIFIED CoWEB

So far we have learned a lot from literature study, the end user study, the observation on an online community and the comparison of three virtual community systems. We have also got some user requirements based on these studies. What would our target user group think about these results?

When this project arrived at this stage, we thought it was the right time to build a prototype according to the findings so far and show this to the end users. Indeed it was. But we had two problems: Building a fully functioning prototype would be expensive and time consuming; at the time we could not reach our target users because they are spread all over the Netherlands and it was difficult to get them together for the user study.

Since we felt that the CoWeb was closer to what we wanted, we decided to mock up a CoWeb with graphical tools. This enabled us to quickly reshuffle the interface components and the functions of the CoWeb with add-ons according to our findings. We then presented this prototype to a committee, which consisted of the project owner, a professor who is an expert in the field of communities of practice, and three trainers from teacher training centers. Most of them knew the target users very well, so the feedback from them should be close to what we could get from the real users.

This chapter presents the design decisions made, the functional design and the feedback got from the walking-through.

6.1. Design decisions

6.1.1. Why CoWeb

We decided to take the CoWeb other than the Usenet or weblogs as the starting point for designing the mock-up. Besides the reasons we mentioned before, the decision was made also from the end user's perspective:

The CoWeb provides a convenient and effective way of information sharing and collaborative writing. It made it possible to add and edit text, image, tables and even certain interactive components (for example, Java applets), virtually almost any type of data.

The CoWeb also encourages participation and hence gives a strong sense of social community. The open way of collaborative authoring has some profound and subtle advantages. Allowing users to create and edit any page in a Web site is exciting. It

creates a democratic atmosphere and promotes the content composition by not an individual, but a group of the individuals. Additionally, Many CoWebs include a WYSWYG rich text editor that allows users to create web pages like editing an article in a word processor, which interface is more familiar to our end users. Besides, users can also comment on any page instead of directly change it which shows their respect to the original authors. The comments or discussions made would help and encourage the author to improve the article in his/her own way. Democracy and respect coexists in the CoWebs.

The most advantage of the Usenet is that it opens for discussion. But CoWeb can also hold discussions by individuals editing the same page or commenting on it.

6.1.2. Other Considerations

It should be pointed out that people tend to be hesitating to create a new page or modify a page created by somebody else, and sometimes even could not find that a CoWeb page is “editable”, because it is not “*how the Web typically works*” (Dieberger 2000b).

It is also found that the CoWebs are difficult to navigate. The content structures are not managed by the system as other web sites do; but instead, they are managed by the users within the content itself. Appropriate navigation scheme, for example social navigation, may help people to find their way, and prevent them from getting lost.

6.2. Functional design

6.2.1. Top-level accessibility

Links to the home page

A link to the home page is presented on every page at the same place so that the user can always to start from the beginning wherever they are and whenever they want. This can be a convenient fallback if the user gets lost and they could not find any other ways out.

Search engine

A simple full text search function is presented on every page with a link to advanced search. The full text search engine provides the possibility to search entire system with a keyword or keywords. The advance search gives change to advanced users to search with more detailed such as author’s name, creation and modification time, to combine search conditions with logical algebra, and to limit and narrow down their search to a smaller area.

Help

Besides a manual with introduction and tutorials, the system provides context sensitive help on every page.

6.2.2. Registration and customization

Registration

Registration is not required. But only registered users have more privileges such as removing a page, attaching files to a page, online chatting, accessing to “my pages” and customizing the system

Customization

The system allows a registered user to customize the look and feel of the pages according to the preference. The user can also decide whether the system should show his/her online status to others.

6.2.3. Collaborative editing

The users are free to create, edit and remove the content within the system, including adding and changing the text, removing part or entire page, linking to other pages with CoWeb links to internal pages or URL’s to external pages, embedding images and internal pages, and attaching any other type of data as a file.

With the freedom of editing, the users feel equal to each other. This can encourage them to stay in and contribute to this system.

WYSWYG editing

The system provides a WYSWYG rich text editor as Microsoft Word has for easy editing, instead of using a plain text editor with syntax tags. But markup language based plain text editing is kept for advanced users. Direct HTML marking up should be prohibited since it causes security problems and inconsistency in formatting.

Printing

On each page there is a link to printing function.

Previewing

There is a function for previewing a page before publishing and printing.

Publishing

The system allows the users to publish a newly created or edited page with a possibility to cancel or discard the changes that have been made.

6.2.4. Social navigation

Popularity and Freshness of a page

The popularity of a page indicates the traffic, and the freshness shows how long ago that page was last modified (Dieberger 2000b). The users can sort the page list by either the popularity or the freshness of the pages.

Recent changes

The system provides a summary of the changes of the content (changed page list). A user can choose to show a list of “Latest changes”, “changes in last 3 days”, “changes in last 7 days” or “changes in last 30 days”. “Recent changes” indicates the amount of activities of the system.

Who else is online

It shows a list of online users with their personal information. It gives the users certain degree of social awareness – the user is not alone in this community. The personal information is shown according to the personal preference whether and which personal data should be shown to the public.

In some of the CoWebs, the personal information is shown as a page when a user name is clicked. We think it might be disturbing if the user is distracted away from the content. We choose to show this information within a callout window when the user moves the mouse cursor to the name and stop the cursor on the name for a little while.

Who else is reading this page

It shows who else is reading the same page and their personal information if available. It might result in direct social navigation if one would like to chat with others about the page that they are reading.

My pages

It shows a list of the pages that was created or edited by current user, with their popularity and freshness. This function is not a common feature of most CoWebs, but it provides the traces that the users themselves left. This may give the users a feeling of contribution and achievement, which will encourage them to contribute more.

Other versions of this page

It shows a list of different versions of the current page with version numbers, editors and their personal information if available. An icon will also be shown together with the editor’s name to show the online status.

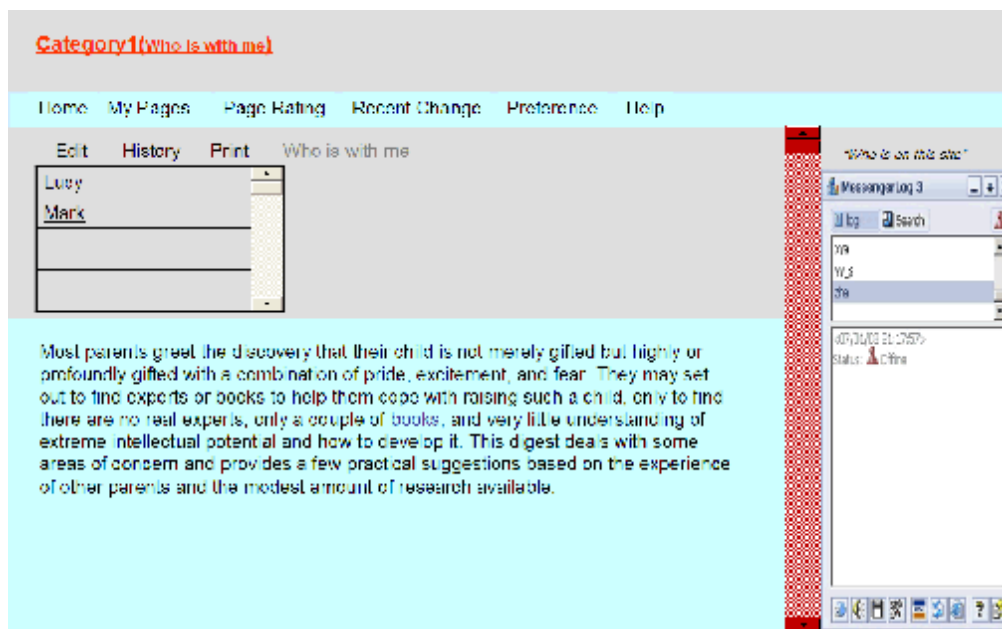


Figure 2. "Who is with me" in modified CoWeb

6.2.5. Online chatting

The system also provides online chatting. The user may chat with many others in a public chatting room about the page that they are reading together, may also chat with another user in a private room.

Figure 2 shows the interface when a user is reading a page. When the user move the mouse cursor over "Who is with me", a popup menu shows the users who are currently reading the same page or the same category. On the right side of a page it shows the users that are online. Moving the mouse cursor over a user name will popup a callout window with this user's personal information, in which there is a link "chat". If it is a "with me" user, "chat" may lead to a public conversation that all "with me" users may join, otherwise the user is invited to a private conversation.

More screenshots of this mockup prototype are given in Appendix C.

6.3. Feedback

This mockup prototype was walked through together with the committee. The feedback from the committee can be summarized as following:

1. Additional social navigation requirements.

Within a page, the users should also be able to see the others' comments about current page. The comments can consist of the degree of the agreement and possibly some text for explanation.

Solution:

For those users who want to comment on the page, it should be possible to select part of the content within a page, then vote and add comments about this particular part. The content they select has to include at least one sentence.

For the readers, they will see the voting result, the number of people voted, the number of the comments, the authors of the comments and their online status, and the content of the comments if the user want to read further.

Design:

Small icons can be added after each commented sentence or paragraph if there are votes and comments. Moving mouse cursor over the icon will pop up a callout window that initiates further information and interaction.

2. The “Who is with me” concept is not user friendly.

The users should be able to see who are on the same page immediately without any clicking.

Solution:

The users will see how many people on the same page once they open a page. This function can be integrated with the online user list on the right site of the page, and these online users should then be categorized into “users on the same page”, “users on the same category”... and “other online users”. Categorization can be done with separated lists, or different icons for different categories.

3. The social navigations in the system are all top-level, which seems too abstract. The system should provide social navigations in local contexts.

More social navigation cues should be available at the level of internal pages, such as users on the same page, experts good at the topic, and comments and questions about this page and their authors.

The system could also show the users that are close, for example, the users who are in the same category, and the users who are reading a page that this page has a link to or is linked from.

7. SUMMARY OF THE REQUIREMENTS

In this chapter we try to summarize what have learned so far about the communities of practice and the social navigation. Because social navigation is rather a design approach than a system, the requirement definition on social navigation will consist of two steps: first looking at the possible actions or activities which users may perform in the given community of practice, then analyzing the possible ways of social navigation that the system should provide.

In this chapter, the requirements are numbered and listed in italic type.

7.1. Requirements on the community of practice

The user requirements towards a community of practice consist of three parts. The first part focuses on the benefits that the users can get and how the system should provide with. The second is about the social awareness. The third deals with management issues.

7.1.1. Benefits

Providing an efficient idea exchange

The system should be able to support different types of the idea exchange activities, mainly collaborative writing, commenting, and chatting. We will come to this issue again later in next section.

- 1. The system should support collaborative editing.*
- 2. The system should allow the users to comment on other users' contributions.*
- 3. The system should allow the users to discuss about a contribution.*
- 4. The users would like to ask questions about both a particular contribution and a general topic which is not yet covered by any contribution.*
- 5. The system should provide private and public chat rooms for online chatting. Public chat rooms should be well structured along with the content.*

Providing high quality content

The users, especially the new teachers, come to the system for quality information. The quality is not only about the content itself, but also about the form of the content. Only text would be dry and boring. The content should be able to be well structured with proper formatting and layout.

6. The system should not start from an empty skeleton, instead, it should launch with a certain amount of quality content for the new teachers to read.

7. The system should involve experts and experienced teachers to provide quality content.

8. The content should be in rich text, supporting hyperlinks (hypertext), embedding images and tables.

9. The system should provide formatting and layout tools for easy editing, but at the same time should limit the possibilities of formatting and layout to a unified look and feel.

Helping for problem solving

To solve a particular problem, the user may first try to look for solutions in the archived content. There are two ways to locate wanted content – browsing through archives and searching by given keywords. This requires the system to provide well categorized content and a powerful search engine.

Many of the questions are common and might have been answered already. The system should provide a list of such questions, and the answers as well.

When the user cannot find the solution in the archives, the user has to post the question to the system asking for answers, guidance or advice. One problem might be that the user does not know where to post the question. A well written instruction should be available for this purpose.

Once the request is posted, sooner or later there should be somebody willing to help. The system should encourage people to help others by for example giving credits.

10. The system should involve experts and experienced teachers as volunteers to answer questions and give advice, to minimize the number of ignored questions and requests.

11. There should be a well written instruction about how and where to post the questions.

12. Those who help others to solve their problems should be credited in one way or another.

13. The system should categorize the archived content, when that is not possible, should at least categorize the high quality content.

14. *The system should have a global FAQ, and a FAQ for each category.*

15. *The system should have a powerful search engine.*

Helping people do their jobs

Besides the requirements on the content and problem solving, the users need to get help and advice in time in order to get their jobs done. In case they could not find needed content and there is nobody replying to their request,

16. *The user should be able to directly contact someone for help. A list of online users and their personal information, especially their expertise, should be available for the user to make the decision who to ask.*

17. *A list of experts and experienced teachers together with their expertise should be available for both online (if they are online) and offline communication.*

Helping develop individual skills and competencies

The users have different interests in certain topics. They should be able to collect the articles that they consider to be helpful and useful, and to categorize them according to their own understanding.

The personal development of a user should be appreciated by the system. This can be done by monitoring the amount of the contributions the user has made to the community and how much credits the user has got from helping others.

18. *The system should provide a function for the user to collect or bookmark interesting content (as “My favorites” in most modern web browsers, but the items should directly link to the articles).*

19. *The users should be able to categorize their collections.*

20. *The system should monitor the development of the users by counting their contributions and credits.*

Providing greater access to experts

As we have already mentioned, involvement of experts and experienced teachers are crucial for providing quality content and hands-on help, so the system should at least provide a list of experts for the user to contact with. But how should these experts and experienced teachers be qualified in the system?

21. *At the beginning, the system should start with a list of experts and experienced teachers who are qualified and willing to help.*

22. *Any user can be an expert if there is enough quality contribution, and enough credit. The quality of the contribution should be decided by others, and credit should be given by those who get their help.*

23. *A user should be no longer an expert if the user is no longer helping others or making contributions for a long time, or whenever the user wants to quit the expert duty.*

24. *Experts should also be categorized according to their expertise.*

25. *A link to “who is good at this topic” could be handy.*

Increasing members’ motivation to learn

The motivation to learn very much depends on what can be learnt. The quality of the content is crucial again in this case. So to increase the learning motivation, the first step is to ensure the quality.

The system could not monitor how much the users have learnt from the community, but can monitor the amount of the contributions. A way to contribute is to write a summary of or guidance to other posts. This kind of contribution reflects partially how much a user has learnt. This should be encouraged and credited, because it not only increases the users motivation to learn, but also could be used for social navigation.

26. *The system should encourage and credit the users who write summaries and guidance.*

27. *Summaries and guidance should be well categorized and easily accessible.*

Providing challenges and opportunities to contribute

Some questions are difficult to answer, and after certain period of time, it becomes a challenge. “Difficult questions” or “Highly wanted” areas could be a good idea to challenge the users. More credits should be given if these requests are stratified.

Nothing should stop the user from contributing and all the contributions should be credited no matter the quality. Removing any others’ contribution should be done with great care and should be done with enough privileges, because this could kill the user’s enthusiasm of contribution.

Allowing other users to comment on the content or simply show their gratitude would encourage the original author to contribute more. So if a contribution received more comments, it should be credited more.

28. *A request should become “Difficult questions” or “highly wanted” if no response to a request for a long time.*

29. *No contribution should be rejected, and all contributions should be appreciated.*

30. *More feedback, more credits.*

31. *A contribution should only be removed with enough privileges. Removing should be always recoverable.*

Developing professional relationship

As we found in “Teacher Focus”, professional relationship could be build up along with the conversations among the users. These conversations could be private between two users, could also be public among many users. Common interests in these conversations play an important role in developing professional relationship.

These conversations could be online inside the community, could also be offline outside community. The system should encourage both of them. Online conversations could be done in chatting rooms, and offline conversations should encouraged by showing possible ways of offline communication, for example, the email addresses, telephone numbers, and instant messaging identities of the users.

32. The system should group the conversations according to the topics so that the users can share their common interests.

33. The system should encourage both online and offline conversations among users.

7.1.2. Social awareness

Showing who are currently online together with the user cannot only make the community of practice more sociable, but also provide greater chance to contact with others in one click. As in physical environments, people in a virtual space are located in different places, such as different categories and chat rooms. Therefore,

34. The system should show the presence of the other online users.

35. The system should also categorize the online users according to where they are currently located. “Users on the same category”, “Users on the same page” and “Users who are good at this topic” can be helpful.

7.1.3. Management issues

In CoWebs, users are equal. But we found that the existence of moderators can be helpful for making and maintaining the rules, checking and managing the content. The moderators in “Teacher Focus” appear to be not only a moderator, but also a responsible and warm-hearted expert. They show the new users around, answer questions that nobody else is answering, post articles with high quality, write guidelines and instructions, which is very much appreciated by other users. Their privileges are often used for house-keeping: reformatting text, removing duplicated content and lock certain articles that should not be edited (for example, a citation from a book). Our users would also welcome such moderators in our system.

36. Experts should be able to volunteer to be a moderator for a top level category.

37. The system should provide access control. A moderator should have certain privileges, for example, removing certain articles for house-keeping.

7.2. The basic structure and activities

To find out the possible social navigation approaches, the basic structure of the navigation space should be defined, as well as the activities in this space. Some ideas below are borrowed from the CoWeb for collaborative writing and the Usenet for asynchronous discussion.

7.2.1. Metaphor

To identify the basic structures, we would like to start from a metaphoric scenario:

Johan has some great ideas so he comes to a whiteboard and writes it down on the whiteboard (creating a page).

Others come around and read what Johan wrote. They discuss about it and write down the key points on another piece of paper (discussion). Some of them start form smaller groups to talk about different topics (private chatting).

Some of them start writing down what they think about Johan's idea. They wrote on yellow notes and stick them around Johan's sentences (inline commenting).

Peter comes. Johan told him that he had some great ideas on the whiteboard so he comes to see what these great ideas are (social navigation). Peter does not understand one of the statements on the whiteboard, he ask people around (chatting).

He now understands what it is about. But he thinks there is a better way to state that idea. He grabs a pen – “But wait a minute, Johan might want to keep what he wrote.” So he uses a digital camera, takes a picture of what is on the whiteboard (version history). He then erases the sentence and writes a new one instead (collaborative editing).

Some of the rest does not agree on the change Peter just made. They start arguing about it (chatting) ...

From the above scenario, we may see that there are basically three different means of information exchange: the whiteboard, the yellow notes, and discussions. It corresponds to the basic structure of our system: internal pages, comments and chat rooms.

7.2.2. Basic structure

38. The target system should include at least the following four parts:

Internal pages

Internal pages are the basic components as the pages in the CoWeb and Wiki-WikiWebs. People are free to create and modify the pages and hence every page many have many versions. The internal pages are where people collaboratively create content, share their knowledge and information.

The overall content structure of the system should be maintained by the users themselves. The users may create special category pages and link other content pages to the category pages as in many CoWebs and WikiWikiWebs. In the home page there could be a tree of links to these categories and reversed searching on a particular category can provide a list of the pages that belong to this category.

The system should also allow the users to evaluate how interesting a page is (rating). One may argue that rating involves extra efforts from the users. But rating should only be done voluntarily, and we do not expect extra efforts from the users when the content is just so-so. The users might be willing to do one more click when the content is very helpful and they want to show their gratitude, or when the content is useless and they hate it. In both cases, the rating results would be helpful for others to find the most interesting content.

39. The target system should support version control on the internal pages.

40. The system should be able to categorize the internal pages by linking them to special category pages

41. The system should support rating on the internal pages.

Inline comments

People may hesitate to modify the content created by others, but would like to add inline comments to the content to show their respects to the author. Inline comments are also a common way of collaborative writing and editing, especially very helpful when reviewing someone else's work and giving suggestions. This is often supported in contemporary word processing software, for example Microsoft Word, OpenOffice Write and Corel WordPerfect, but not often seen in most of the Web-based collaborative environment such as the CoWebs and the WikiWikiWebs.

Another advantage to inline comments is that it can keep the history list to a necessary minimum. A page will become history page once there is any change on it. The history version list might become too long to be useful. A comment on the page is often not perceived as a change to the content and thus should not be recorded in the version history unless the associated part of the content is changed.

As collaborative editing is the most wanted function, we suggest the future system should support commenting in the lines of the internal pages. The system should allow the users to comment on an internal page, or part of the content of the page.

The inline comments should be able to be not only shown directly inside a page, but also, indicated by small icons indirectly first. The user may move cursors to these icons in order to read the comments, and if they would like, to add new comments. The users should also be able to hide all the comments and even the icon indicators away for easy reading.

Discussions

One of the most appealing features of the Usenet is that it supports asynchronous discussions. Often, the users would like to have a dedicated area to discuss about an internal page instead of directly insert their comments into the content, in many cases:

1. The users may want to comment on the page in general, not a particular part of the content; when commenting on the entire page, it is hard to decide whether the comment should add to the top of to the bottom.
2. Although the users may just directly insert their comments into the page without changing original text, it will make a page longer and people do not like to scroll a page as told by conventional Web design wisdom. Dieberger also pointed out that people tend to add only to the top of the page when page is too long (Dieberger 2000a), and this will make the page a mess. Take the discussions outside the page would help to shorten the page.
3. A discussion is often done in an asynchronous relay manner. It requires a different structure to record the topics and replies.
4. As the inline comments, the discussion on the page does not start a new version either.

The discussion on a page should be organized into topics and replies as it is done in the Usenet in order to take the advantage. This is also where a user should ask questions. A question is a special topic that marked by the user requesting for answers from the others. Because these topics are marked, it is possible for the system to collect the questions, especially unanswered questions from a page and from all the pages as well.

Chat rooms

Every internal page is associated with a chat room, where the users may join to talk about the page as the topic. There should also be chat rooms which are not associated with any page where the user may decide the topics. These unassociated chat rooms should be categorized so that the user can easily find one.

The user should also be able to start a private chat room that only invited users may join.

Chat rooms are different from the discussions in two ways:

- The conversation in a chat room is done among online users in a real-time and instant manner. The discussion on page is done in an asynchronous manner which does not require all the participants to be online.
- The system does not record the conversations in the chat rooms.

7.2.3. Activities and social navigation

Internal pages

Possible activities on the internal pages are:

- Creating a page;

-
- Editing the page;
 - Reading the page and the comments;
 - Evaluate the page by rating;
 - Navigate away from the page.

These activities could create or leave the following traces for social navigation:

1. Number of the visits;
There are always more information consumers than producers. The amount of visits on a page aggregates the activities from both of the consumers and the producers. It indicates the popularity of a page and what people are interested in. It may help people to decide whether they should read or not. It may also encourage people to contribute because they see that there are so many others are interested in their contributions. However, the number of visits seems self-perpetuating – a big number invites more visits and in turn makes it even bigger. This increase does not reflect the quality. But it shows the flow of the community at any time and the users can get a feeling of community.
2. Recent changed pages, including newly created pages;
3. Rating results from the others;
4. Users who are reading the same page;
5. The pages that most of the users visited before visiting this page;
6. The pages that most of the users visited right after visiting this page.

Inline comments

Possible activities on comments are:

- Adding a comment;
- Editing and removing a comment;
- Reading the comments;

These activities could create or leave the following traces for social navigation:

1. Recent commented pages: it aggregates the pages that have comments.
2. Number of comments of page: To a certain extent, it indicates how much the community are interested in this topic

Discussions

Possible activities in discussions are:

- Creating a new topic;
- Replying to others;
- Creating a question;
- Answering a question;
- Reading the discussion;
- Editing or removing an item created by the user herself/himself.

These activities could create or leave the following traces for social navigation:

1. Recent discussed pages: it aggregates the pages that have a discussion.
2. Number of topics in the discussion
3. Number of questions in the discussion
4. Number of unanswered questions;
5. Recent questions;
6. Never answered questions, sorted by the date the question is asked;

Chat rooms

Possible activities are:

- Initiating a chat;
- joining a chat;
- Inviting others to join the chat;
- Chatting;
- Leaving the chat room.

These activities could create or leave the following traces for social navigation:

1. Number of the participants of a chat room that is associated with a page;
2. List of the chat rooms and their topics.

7.3. Requirements on social navigation

As mentioned in the literature study, there are three aspects of the benefits from social navigation approach:

- Guide users to find relevant and important information
- Help users make decisions and selections
- Enhance social awareness and increase the willingness to participant.

Based on the activity analysis, it is not difficult to conclude about which social navigation approaches the system should use. Moreover, the final requirement definition shall combine the social navigation approaches found in the previous chapters so that the above benefits will be covered better. For example, as mentioned in Chapter 4, the users would like to follow certain people with whom they share common concerns and interests. The contributions from these people could be more useful than those from others.

We summarize the social navigation approaches as following to conclude this chapter:

Global social navigation approaches

42. A list all the pages that a certain user has contributions to;

43. A list of online users.

44. A list of the all pages that can be sorted by

-
- *The number of the visits;*
 - *The date of the last change;*
 - *The number of topics in the discussion;*
 - *The date of the last topic in the discussion;*
 - *The number of comments;*
 - *The date of the last comment;*

45. *A list of most visited pages;*

46. *A list of recent changed pages;*

47. *A list of recent commented pages;*

48. *A list of most commented pages;*

49. *A list of recent discussed pages;*

50. *A list of most discussed pages;*

51. *A list of highly rated pages;*

52. *A list of the topics that people are chatting about.*

Local social navigation approaches

53. *A public chat room that is associated with a page;*

54. *A list of the users that are involved in the chat room that is associated with a page;*

55. *A list of online users who are on the same page.*

56. *A list of the pages that most of the users visited before visiting the current page;*

57. *A list of the pages that most of the users visited right after visiting the current page;*

58. *A list of the others who are close to the user in the virtual space, for example, those who are in the same category, and those who are reading a page that the current page is directly linked from or directly linked to.*

59. *A list of the topics in the discussion about a page;*

60. *A list of the users who created, last modified, last commented and last discussed about a page;*

8. A CONCEPTUAL DESIGN OF SOCIAL NAVIGATION

This chapter gives an example how the requirements defined in the previous chapter could be implemented at a user interface level. As an example, it is not necessary to go into every corner of the system. Since the internal page is the most important place where people share their ideas and opinions, it is a good candidate for us to sketch our concepts on.

As in the CoWebs, the internal pages are most often visited, but they are difficult for the users to navigate and to locate relevant and useful information. Integrating social navigation approaches within the internal pages can be an enhancement.

To find right social navigation approaches, it is important to make sure that the users understand what kind of information they are disclosing and how it is used (Dieberger et al., 2000).

The social navigation approaches defined in the previous chapter are mainly focus on the enriching history information and providing read-wear information on a page. These navigation cues can be the access history, the modification history, the most recent comments, and the most recent questions etc. There are mainly two considerations when we decide which cues should be used:

- There are many kinds of read-wear information on a page which can give different social navigation cues. These social navigation cues can be represented by small icons so that we can show as many as possible. Wherever a link to the page is presented, these small icons follow right after. However, the link is often added to a word or a sentence, too many icons in the text will decrease the readability.
- Many social navigation cues are information collected and aggregated from the activities of all the users in the system. Therefore most of these cues can be shown as a list in a separated page or as a pull down menu. Buttons or links could be used to activate these pages or menus. But as mentioned in the feedback from the modified CoWeb, the user cannot see the social navigation cues directly and it requires an extra effort to activate the presentation of these cues.

The two considerations seem contradictory. On the one hand, we want to use the social navigation cues as few as possible inside a page to ensure the readability; on the other hand we want to show the social cues directly as many as possible to lower the effort involved in social navigation. We have to either trade the readability for the

space to show more cues, or vice versa. We cannot overcome this problem unless we try to optimize the tradeoff – a typical challenge in design.

In a page, we decided to only present the local social cues that are most often used directly along with the links to the page. The rest of the social navigation cues about the linked page will be shown in *callout* windows. The callout windows are the windows that pop up when the mouse cursor is above the link and disappear when the cursor is moved away. The same strategy will be used for the links in a callout window. That means extra social navigation cues will be available only when the user needs it. The use of “moving over and showing a callout window” instead of “clicking and popping up a window” requires less mouse clicks and hence less user effort for the social navigation.

The global social navigation cues are independent from a specific page; hence it is not logical to show them inside a page and they should be separated. Most of the global social navigation cues require a list, often a long list, to present. Direct listing together with an internal page would squeeze the space for reading and editing. So we decide to keep the buttons for activating the lists. To compensate, we should show briefs of these global lists directly whenever is possible, for example, the number of the online users, the number of the users who are on the same page. More details can be shown in callout windows when the user moves the cursor over the brief. Clicking on these briefs would activate the page showing relevant list with all details.

However, we have to point out that the above optimization is purely a design decision made with conjectures, and we cannot say this is a right decision. To make this optimization right, we need to engineer the usability, which is out of the scope of this project.

8.1. Local social navigation cues inside a page

As said, in order to ensure the readability, we only want to show the icons of the most often used social cues inside a page for social navigation. We do not know yet which social cues are the most often used ones. Again this needs a design process to make the choice, or we may leave this to the users – they decide which cue icons should be shown along with links according to their personal preference. As an example, we assume that the popularity is a right choice. Figure 3 shows the popularity cues assigned along with the links in a page. The different colors indicate the different level of popularity of the linked page. Red dots appear very “hot” and indicate the very popular pages. The color turns orange, and then yellow when there is less traffic to the page.

News

Johan recommended some [books](#) ● about [class management](#) ●. From these books, he found some useful tips and tricks about [how to deal with naughty boys](#) ●. Very interesting.

Figure 3. Links with popularity

Once the mouse cursor is over the link, a callout window shows additional social cues (see Figure 4), such as the author of the page, who else edited, the date of creation and the last modification, online status of the authors, and who else are reading the page. When the user moves the cursor away from the link the callout window disappears immediately.

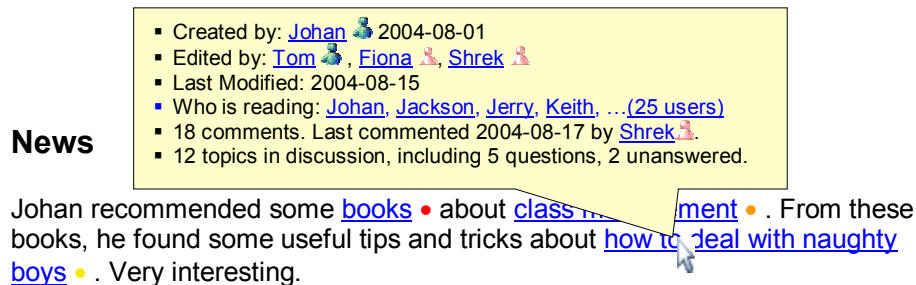


Figure 4. Callout window with additional social cues

We may also find that in the callout window, there is often not enough space for certain information, for example, in Figure 4, we cannot show all the 25 users who are reading the page and only few users are listed. Moving the cursor over the link of “25 users” will pop a callout list showing all the 25 users (see Figure 5).

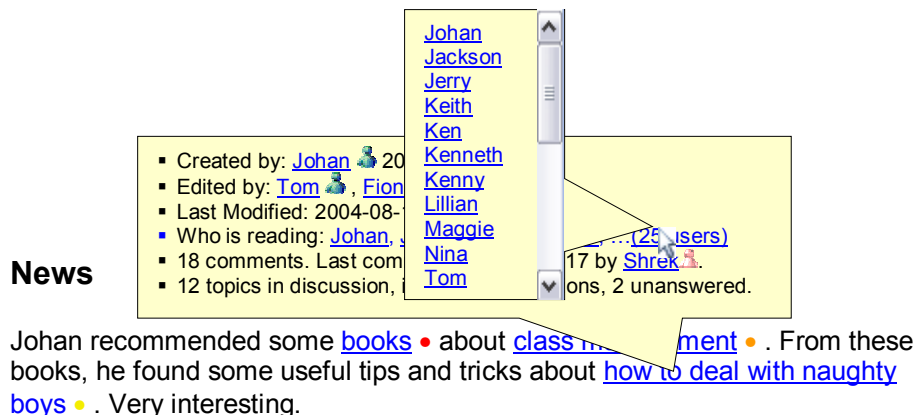


Figure 5. More callouts

Moving the cursor over a particular user name will pop up a callout window shows his/her personal information, including the user’s expertise and a summary of his/her contributions. The user may then decide whether to join or initiate a chat with him/her.

We have to point out only few modern web browsers support callout windows, and some of them only support one layer callout. This remains a concept and we leave this to the implementation.

Too many overlapped or nested callouts might also cause usability problems. We have to find proper trade-off between the direct shown social cues and the callout shown ones. We may also leave this to the user; the user decides which ones should be shown inline with the page, to what extent they should be shown, or not to show them at all to gain maximum readability. In Figure 6, the user decides not to show any of the social cues and leave all of them to callout windows.

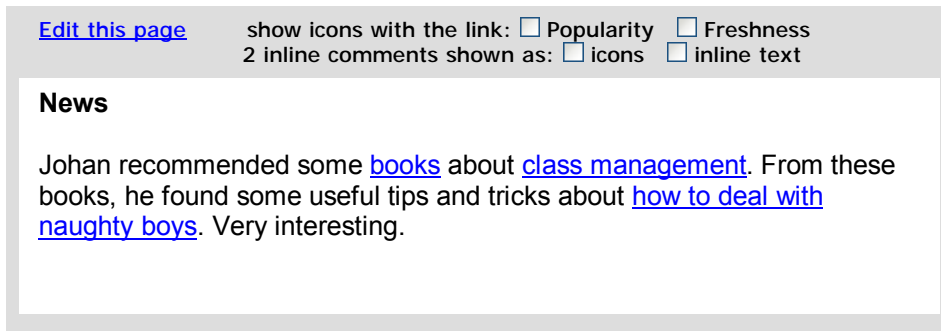


Figure 6. No inline social navigation cues

When there are any inline comments, the user may decide to show them as icons and use callout windows to show the details (see Figure 7), or to expand all the comments as in line text if the user doesn't mind readability (see Figure 8), or to show none of them.

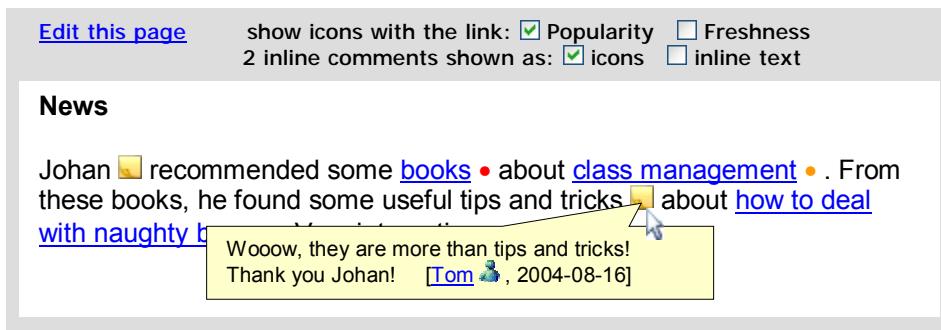


Figure 7. Comments as icons

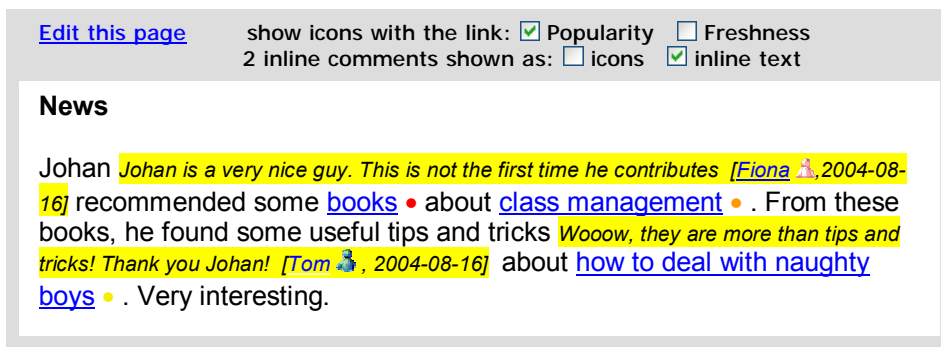


Figure 8. Comments as inline text

As we can see from the above pictures, there is always a tradeoff between the amount of the social navigation cues direct shown in the page and the readability of a page. This holds not only for the cues inside a page, but also for the cues about a page, and the global social navigation cues as well. We always need to optimize the tradeoff in the design. We are not going to argue about this again in the rest of this chapter.

8.2. Local social navigation cues about a page

From the data structure point of view, a page is an article associated with 3 other elements: the discussion on the article, the revision history and an online chat room. We may leave the online chatting function to another dedicated system, for example, an IRC (Internet Relay Chatting) service. We associate the page with a unique chat room in service, for example, “ThePageTitle_from_OurSystem.com”, so that we can leave the complexity of chatting service out and only need to provide a link to this chat room in the page. We might need a list of the users who are currently in the chat room, which can be done with a simple query to the chat room using the IRC protocol.

Now that the chat room is left out, we only need to take care of the discussion and the history. We organize them into tabbed sub pages (Figure 9).

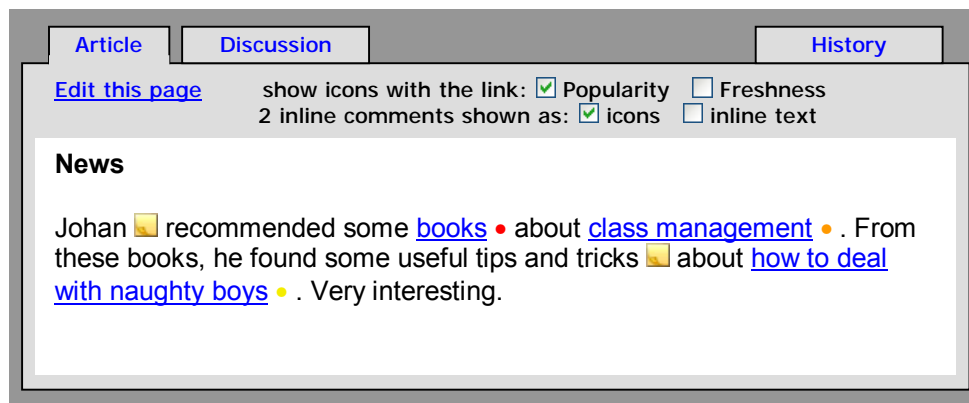


Figure 9. Tab interface for discussion and revision history

We show the brief of the social navigation cues about the current page at the bottom of the page (Figure 10). When the article is long and it requires scrolling, the designer has to make decision whether to keep the brief always at the bottom and only scroll the article, or expand the article with the full length and scroll the whole page together with the interface. We suggest keeping the brief always visible when the brief does not require too much screen space so that the social navigation cues can be reached at the first glance or within one click.

Some of the local social navigation cues mentioned in the user requirement are not shown in Figure 10. Limited by the space of the figure, we only show the concept instead of covering all the requirements.

Moving the mouse over the links in the brief, the user will see more details about the social navigation cue. For example, when the cursor is over “chatting”, a callout window will show an introduction to the chat room and who are currently in the chat room, whereas clicking on “chatting” will lead the user directly to the chat room; moving the cursor over the first “these pages”, a callout window will show a list of the pages that many people has visited right before visiting this page.

The user may also move the cursor above the tab titles of other two associated elements to see the briefs of them. In Figure 11, a callout window shows the brief of the discussion.

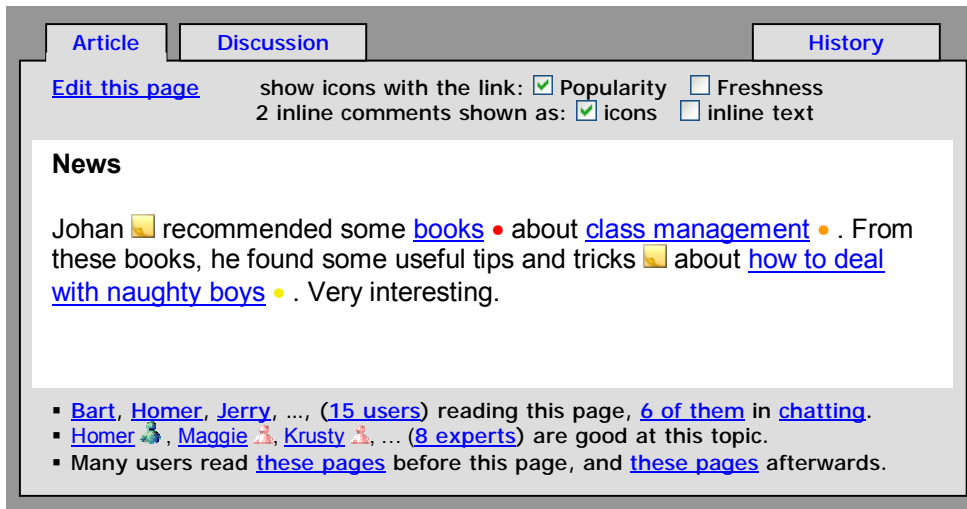


Figure 10. Social navigation cues at the bottom of a page

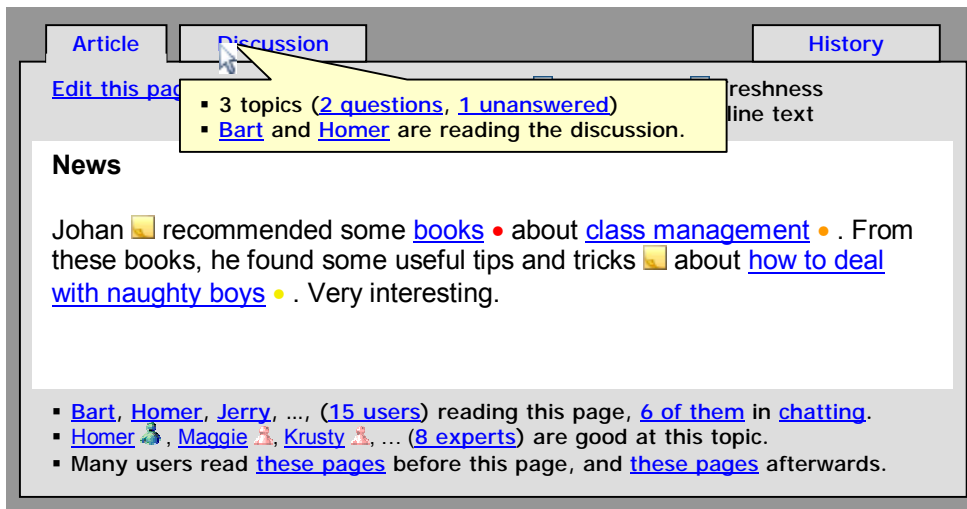


Figure 11. A callout window shows the brief of the discussion

The user may click on the tab titles to enable the tabbed element. In Figure 12, the Discussion tab is enabled and the article hides. The user may click on “New topic” to start a new thread, or on “New question” to start the new thread with a question. A question is just a kind of special topic that initiated with the “new question” link and marked with a question mark, otherwise there is no difference, but it is expected to be useful, especially for the new teachers, to post their questions asking for help. On the top it also shows a brief of the discussion: how many topics there are in total, including how many questions, and how many of them have not yet been answered.

Again at the bottom of the page it shows the social navigation cues. There are not so many cues about this discussion, so we list all of them in detail: Bart and Homer are reading this discussion.

As shown in Figure 12, topics and replies are organized in a typical newsgroup manner: topics are sorted according to the date, and replies are nested into a tree like

structure. The operations on the topics and replies are almost the same as those on the newsgroups. We expect this will bring the advantage of the newsgroups into our CoWeb-like design.



Figure 12. Discussion on "News"

8.3. Global social navigation cues

We show global social navigation cues on the top of every page together with other navigation tools (Figure 13). The designers may decide whether to put it on top or at the left or right side. But no matter where to put them, there are always more navigation means than the global navigation tool area can display. As many web designers do, we use nested popup menus and callout windows to save the space.

In Figure 13, we need a line to show a short sentence about how many users are online. Moving the mouse over the number of the online users will pop up a callout window showing a list of all online users. When the cursor is over "these pages", another callout window shows a list of the pages being read by the online users, sorted by the number of the users on each page.

As in Figure 14, when the user click on "Page Lists", a menu pops up shows all kinds of ways of page listing, many of which contain different social navigation cues. Popup menus are different from callout windows. In callout windows, it may contain a small HTML page including hyperlinks, images and rich text, whereas the popup menus can only show a list of items, usually in plain text. With this example, we show that popup menus are also a solution for saving space, not to say this is definitely the solution. Popup menus have different interaction behavior from the callout windows. Using both popup menus and callout windows in one page would possibly confuse the user.

In Figure 15, we show a list of the unanswered questions collected from all the discussions in a callout window, sorted by the date. Again, there are more questions than we can show in a call out window. One way to counter this problem is to use a scroll

bar as we did in Figure 5. Another way is to list only part of it and present a link to all of them or the rest, as we do in Figure 15.

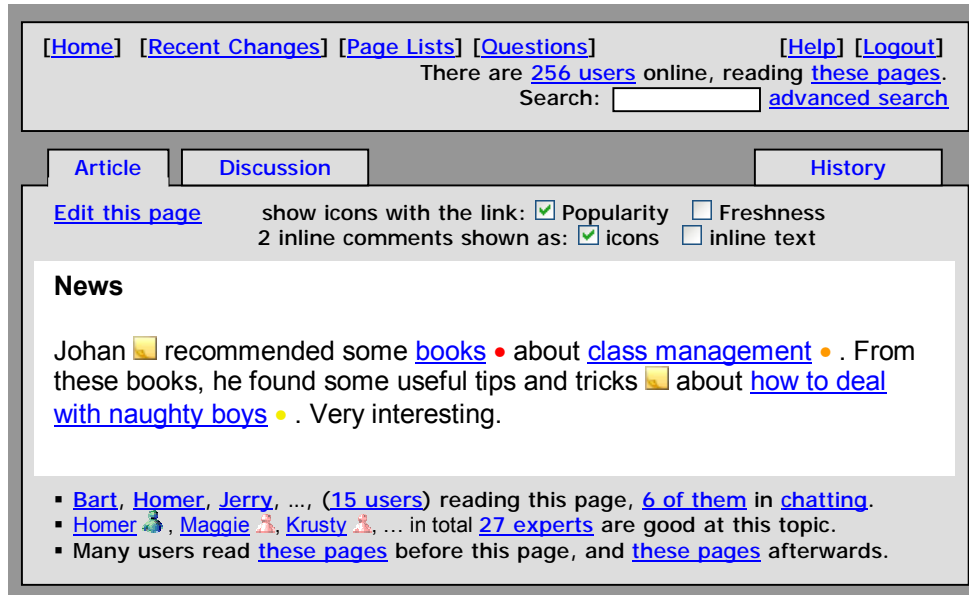


Figure 13. Gloable social navigation cues

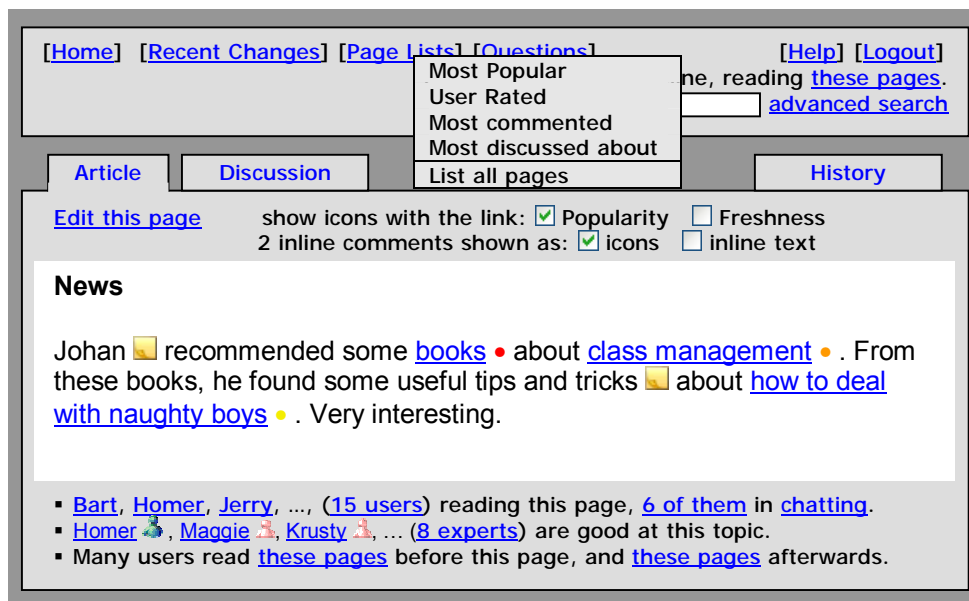


Figure 14. Popup menu to same space

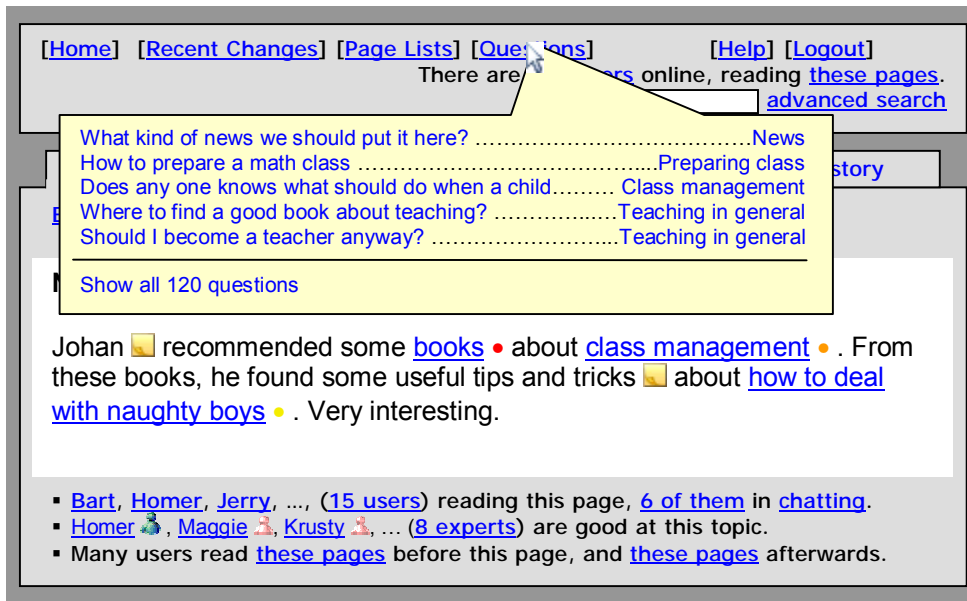


Figure 15. A callout window shows recent asked questions

8.4. Discussion

In this chapter we presented some design concepts about how social navigation cues can be used in the target system, what kind of problems we might encounter in the design and how can we deal with them. Although a lot of requirements are covered, we did not try to present a complete design and cover all the user requirements listed in previous chapter, instead, we take some of them as examples. Moreover, we only paid attention to the social navigation part of the internal pages, we did not take care about other navigation means, for example, content structure based navigation – how to categorized the content, how to present the categories and how to navigate through these categories.

It remains as an uncompleted sketch. To complete the design, there is still a long way to go.

9. DISCUSSION AND CONCLUSIONS

9.1. Social navigation: the new concept

Social navigation is very common social behavior in people's everyday life. There are rich social cues which can guide them through the space and help them find information, such as footprints in the snow and well-worn books in the library. It is a very broad concept and may occur in different ways. There are different approaches used in different domains and with different intentions. The social navigation focuses more on the social experience and the enjoyability rather than the efficiency of the navigation.

Different from the social navigation in the real world, navigating socially in the virtual place is a new emerging concept, but already successful in some of the existing systems. For example, the recommendation system in Amazon.com helps the users to find books with others users' reviews and related purchase. A direct social navigation approach used in an education system EDUCO visualizes the presence of other students and their reading activities.

The forms of social navigation are different in different domains and situations, where they could be more or less useful than in other context. Navigating socially in forests is different from in airports, where people have different intentions and they use different social navigation cues. People assume that the footprints in the forest show the way out, but they ask others where the check point is in the airport.

Similar to social navigations in the real world, the approach of the social navigation in the virtual place depends very much on the structure of the navigation space, and the possible actions or activities performed by people. There is no agreed theory about which forms of social navigation are most suitable or relevant in the design process and how to best design social navigation (Dieberger et al., 2000).

9.2. Challenges

The aim of the project is to define the user requirements of social navigation in a community of practice. The project also has a special target user group - the new teachers from the primary and secondary school who are motivated to exchange information and get help from experts. It was quite clear, but challenges appeared during the project:

-
1. At the beginning of the project, we did not have an idea what our target system – the community of practice for the new teachers – would look like. Without a given navigation space, there is no way to find out how to navigate it.
 2. It was very difficult to reach the target user group. We tried all the contacts given by the project owner, but few responded. We did not get a chance to have face to face contact with any of the real end users throughout the project.
 3. The concept of virtual communities of practice is new to our target user group. Most of them did not have any experience with any kind of virtual communities of practice. It is hard for end users to imagine what they want and how they would like to do it in a never experienced virtual space, although everybody has social navigation experience in real environments.

The literature study told us that designing any social navigation approach requires a defined community of practice. Social navigation is not an end in itself. Its purpose here would be to promote participation and information sharing among the users in a community of practice. We had no other choice but to start from an existing community of the practice: What kind of communities of practice our end users would like to have? How they would like to share their information and exchange their ideas? What kind of activities would they perform in the community?

To counter the shortage of the end user participation, and the limitation of the end user experience with the virtual communities, we decided compensate the end user study with some other approaches.

9.3. Methodologies

Although it was hard to reach the end users face to face, we managed to start our user research using an online questionnaire. The responses were few yet enough for us to get an idea about the user profile. It was a good starting point, but far from enough to conclude the requirements. Three other approaches were then used to compensate:

1. In order to find more needs from the users' perspective, a *similar user group* of an ongoing virtual environment was observed and their requirements were analyzed. The user study on this virtual environment generated more user requirements for both virtual space and social navigation.
2. To get possible information structures and social navigation approaches, more *similar virtual community systems*, namely the CoWebs, the weblogs and the Usenet sites are analyzed and compared. The collaborative editing in the CoWebs was found to be the most wanted feature our target users, whereas the asynchronous conversation supported by the Usenet and the commenting system in the weblogs were found to be useful too.
3. Based on these results, a modified CoWeb was *mocked up*. It was *walked through* by a committee of experts and people who know the end users, and feedback was collected.

During this process, we always first looked at the community of practice, and then tried to find out which of the social navigation approaches were available in the com-

munity, and which ones of these approaches could be used in our future system. The final user requirements combine the results from these studies, and we demonstrated how these requirements could be satisfied at the interface level with a conceptual design of social navigation.

This conceptual design was not fully tested. It would be more preferable to have a chance to do a user study based on this conceptual design with the real user's participation, to make the user requirements more valid.

9.4. Validity of the user requirements

The user requirements gathered from above mentioned methods have different levels of validity:

- Results from the end users with the online questionnaire and the feedback from the mockup walking through by the experts provided primary, important but insufficient information.
- We observed and analyzed a similar online virtual community that had a user group with similar profile, which provided more accurate requirements.
- The comparisons between similar systems made it possible to add something about the content structure and system structure to the requirements. However, this is a typical approach of "what we think is good for you".

The combination of all the requirements gathered from these methods helped to make the results more valid, at least in the sense of the sufficiency.

9.5. Conclusion and Future work

Social navigation in a community of practice is an approach of locating information with increased social awareness in the community. Social navigation alone is not a system, whereas the community of practice is. User requirement definition on social navigation is not possible without the context of the community of practice. In this project, the community of practice remains at the stage of a concept. Although we try to ground this concept with similar systems and some imagination, the result of this study stays preliminary.

The validity of the requirements needs to be improved by testing the conceptual design with the target user group. To make it more convincing and get more accurate feedback, we need to extend the conceptual design presented in this report to a full scale together with all other system elements. More rounds of the prototyping and testing process would spiral this preliminary requirement definition up to the final version.

10. ACKNOWLEDGMENTS

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I also appreciate the participation of and the feedback from the users who joined the user study.

Thank you all.

APPENDIX A: QUESTIONNAIRE (DUTCH VERSION)

Het Ruud de Moor centrum is van plan een web-gebaseerd systeem op te zetten. De beoogde gebruikers van dit systeem zijn zij-instromers voor de opleidingen tot leraar in het basisonderwijs of voortgezet onderwijs. Het te ontwerpen systeem kan gebruikt worden om informatie uit te wisselen tussen zij-instromers onderling. Gebruikers kunnen bijdragen door hun eigen ideeën en ervaringen beschikbaar te stellen voor andere gebruikers. Het systeem bestaat onder andere uit een navigatiesysteem waarmee dit soort informatie gemakkelijk opgezocht kan worden.

Mijn naam is Wen Xu en ik ben een onderzoeksassistent op het centrum voor User System Interaction van de Technische Universiteit in Eindhoven. Momenteel werk ik voor de Open Universiteit aan de ontwikkeling van het hierboven beschreven systeem.

Om het systeem het beste aan te laten sluiten bij uw wensen en mogelijkheden wil ik u vragen deze vragenlijst in te vullen. Het invullen kost ca 5 minuten. Alvast bedankt voor uw medewerking!

Naam: _____ Geslacht: _____ Leeftijd: _____

Algemeen

1. Wat voor werk deed u voordat u aan de lerarenopleiding begon?

2. Hoeveel uur bent u per dag met uw studie bezig?

- Minder dan vier uur
- Tussen vier en acht uur
- Meer dan acht uur

3. Wanneer begint u meestal met studeren?

- 's Morgens
- 's Middags
- 's Avonds

Computerervaring:

1. Hoeveel uur gebruikt u de computer op een gemiddelde dag?

- Minder dan 2 uur
- Tussen 2 en 5 uur
- Meer dan 5 uur

2. Waar gebruikt u de computer?

- Thuis
 - Op school
 - Anders, namelijk
-
-

3. Wanneer gebruikt u meestal de computer?

- Overwegend overdag
- Overwegend 's avonds
- Zowel overdag als 's avonds

4. Waar gebruikt u de computer zoal voor?

- Rapport of werkstuk schrijven
 - E-learning systeem gebruiken
 - E-mailen
 - Chatten
 - Iets kopen via internet
 - Online spelletjes spelen
 - Internetbankieren
 - Informatie opzoeken
 - Iets anders, namelijk
-
-

5. Welke programma's gebruikt u meestal?

- Microsoft Word
-

-
- Microsoft Outlook
 - Microsoft Excel
 - Yahoo! Mail
 - Hotmail
 - ICQ
 - Yahoo Messenger
 - MSN Messenger
 - Iets anders, namelijk
-
-

6. Maakt u op dit moment gebruik van een e-learning systeem (bijvoorbeeld het E-learning system van de Open Universiteit)? Zo ja, hoeveel uur gemiddeld per week gebruikt u dit systeem?

Ja, namelijk

- Minder dan vier uur per week
- Tussen vier en acht uur per week
- Meer dan acht uur

Nee, ik gebruik geen e-learning systeem

Informatie verzamelen

1. Heeft u buiten de lesuren contact met uw medestudenten? Zo nee, ga naar vraag 6

- Ja
- Nee

2. Met hoeveel studenten heeft u buiten de lesuren contact?

- Minder dan vijf studenten
- Tussen 5-10 studenten
- Meer dan 10 studenten

3. Hoe vaak heeft u contact met andere studenten buiten de lesuren?

- Dagelijks
- Wekelijks
- Maandelijks

4. Op welke wijze heeft u contact met medestudenten buiten de lesuren?

- telefonisch
- door te chatten via het internet
- per e-mail
- per post

5. Heeft dit contact betrekking tot uw studie?

- Ja, over het algemeen wel
- Nee, over het algemeen niet

6. Als u buiten de lesuren vragen heeft, hoe krijgt u dan antwoord van anderen?

Ik vraag de docent
Via de telefoon
Via e-mail
Via on-line chat
Ik vraag mede-studenten
Via de telefoon
Via e-mail
Via on-line chat
Ik vraag leraren die ik al ken
Via de telefoon
Via e-mail
Via on-line chat
Anders, namelijk

APPENDIX B: THE ANSWERS OF QUESTIONNAIRE

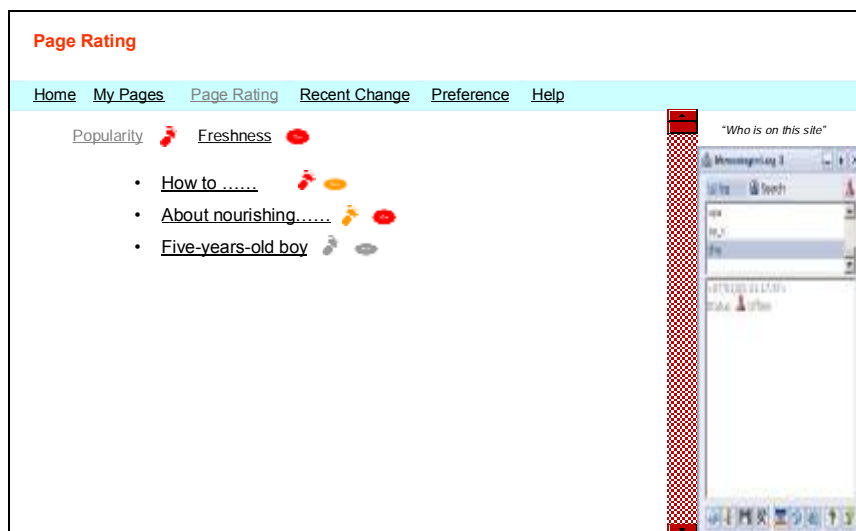
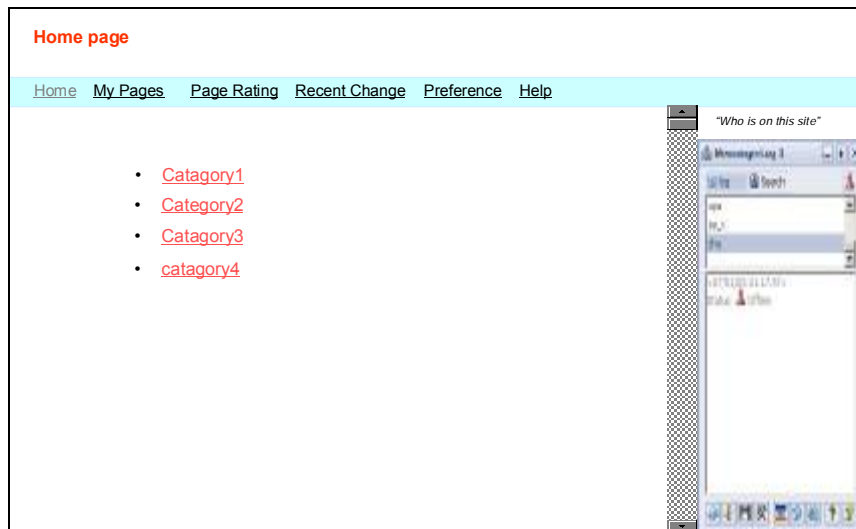
Table 1 of 2:

Questions	Participant 1	Participant 2	Participant 3
Gender	M	M	F
Age	33	34	29
Previous job	Social worker	Marketing manager	Journalist
Study time per day	Less than 4 hours	Between 4-8hours	
Study time	afternoon	Evening	Morning
Total hours of using computer per day	Between 2-5 hours	2-5 hours	Less than 2 hours
Place of using computer	At school and home	At school	At home
Using computer time	Anytime	Daytime	Evening
The reasons of using computer	Write paper Check email On-line banking	Write paper E-learning Check email On-line banking Search information	Check email Search information Join forum of new teacher
Use of computer applications	Microsoft Word Microsoft Outlook Hotmail	Microsoft Word Microsoft Outlook Microsoft Excel Hotmail	Microsoft Word Microsoft Outlook
Using of e-learning system	no	Yes(less than 4 hours per week)	no
Contact other students after school	Yes Less than 5 contacts. Have weekly contact. By: Phone Email The contact is not related to the education study	Yes Less than 5 contacts. Have weekly contact. By: Phone Email The contact is related to the education study	no
The ways to get help from others	Other students	Mentors and other students	Other students

Table 2 of 2:

Questions	Participant 4	Participant 5	Participant 6
Gender	F	F	F
Age	25	25	25
Previous job	No job	Student	High school student
Study time per day			Less than 4 hours
Study time			Morning
Total hours of using computer per day	Less than 2 hours	Between 2-5 hours	Between 2-5 hours
Place of using computer	At school and home	At school and home	At school and home
Using computer time	daytime	anytime	anytime
The reasons of using computer	Write paper Check email Search information	Write paper Check email Online chat with friends On-line banking Search information	Write paper Check email Online chat with friends On-line banking Search information
Use of computer applications	Microsoft Word Microsoft Outlook Microsoft Excel	Microsoft Word Microsoft Outlook Microsoft Excel Hotmail MSN Messenger Dream weaver	Microsoft Word Microsoft Outlook MSN
Using of e-learning system		no	no
Contact other students after school	no	no	Yes Less than 5 contacts. Have weekly contact. By: Email The contact is related to the education study
The ways to get help from others			Mentors and other students

APPENDIX C: MODIFIED CoWEB



Recent Change

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1 day | 3 days | 7days | 30days |

20-03-2004		
How to	17:08	Lucy
About five-years old boys	13:10	Mark
26-03-2004		

Category1

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Edit History Print Who is with me

Most parents greet the discovery that their child is not merely gifted but highly or profoundly gifted with a combination of pride, excitement, and fear. They may set out to find experts or books to help them cope with raising such a child, only to find there are no real experts, only a couple of [books](#), and very little understanding of extreme intellectual potential and how to develop it. This digest deals with some areas of concern and provides a few practical suggestions based on the experience of other parents and the modest amount of research available.

Category1 (Edit)

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Preview Save

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Preview Save

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[Category \(History\)](#)

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Edit History Print Who is with me

	Data	Editor	Action	Diff
5	21-03-2004 08:30	Lucy	View	<input type="checkbox"/>
4	16-03-2004 15:10	Mark	View	<input type="checkbox"/>
3				
2				
1				

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[Category1 \(Diff\)](#)

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Deletions are marked like this	Additions are marked like this
Line 6: and very little understanding of extreme intellectual potential and how to develop it	Line 6:
Line 23: and very little understanding of extreme intellectual potential and	Line 23:

Most parents greet the discovery that their child is not merely gifted but highly or profoundly gifted with a combination of pride, excitement, and fear. They may set out to find experts or books to help them cope with raising such a child, only to find there are no real experts, only a couple of [books](#), and very little understanding of extreme intellectual potential and how to develop it. This digest deals with some areas of concern and provides a few practical suggestions based on the experience of other parents and the modest amount of research available.



Category1(Who is with me)

Home My Pages Page Rating Recent Change Preference Help

Edit History Print Who is with me

Lucy
Mark

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"Who is on this site"

Category1(Who is with me)

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Edit History Print Who is with me

Lucy
Mark

Chat Email

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"Who is on this site"

Category1(Who is with me)

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Lucy
Mark

Chat Email

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Chat Room

"Who is on this site"

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1 day | 3 days | 7 days | 30 days |

20-03-2004		
How to	17:08	Lucy
About five years old boys		
26-03-2004		
	Chat Email	

Who is on this site

Recent Change

Home My Pages Page Rating Recent Change Preference Help

1 day | 3 days | 7 days | 30 days |

20-03-2004		
How to	17:08	Lucy
About five-years old boys	13:10	Mark
26-03-2004		
Chat room		

Who is on this site

Category1 (Edit)

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Who is on this site

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