Web 2.0 contents for connecting learners in online Learning Network

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***Abstract*— The paper proposes a conceptual model for designing a people-finding system in a Learning Network. The system is intended to help a learner in getting recommendation about suitable people who are interested on a similar topic and share common learning goal with the current learner. We propose that by using the user-generated (text) content, social-bookmarking and social-tagging, driven by Web 2.0 approaches, we can implicitly profile people and find people's interests on a given topic. We also like to use their existing social connections as an evidence to select suitable people in recommending a learner.**

Keywords-recommendation systems; web 2.0; social matching; learning technology; social support system; people-finding systems; learning network; informal learning

I. INTRODUCTION

Paul is a student of education sciences, he needs to write a project paper on the topic of "education and technology". Suppose he wants to draft a report on the uses, benefits, roles and implications of the Information and Communication Technologies (ICT) in education. He can start his search on internet and find a plethora of websites, research papers, blog-posts, bookmarks and other electronic resources that could help him to achieve his learning goals. The search will give him enough information, hard enough to decide himself their relevance. On the other hand, he is also interested to connect to people having experiences, interests as well as expertise in the area of "Educational Sciences and Technologies", he can ask for their help, suggestions, build up social connection and share knowledge. In this paper we are interested to bring in attention of a specific class of people-finding systems which are meant to recommend people who are associated, have specific knowledge or interests in a given domain. The problem which motivates this research is inspired by the following comment:

"When I have a question or a problem, I want to be able to immediately figure out who is willing, qualified, and able to help me solve it. Since the problems and questions come in every shape and size, some sublime, some ridiculous, I want my Instant Knowledge System to help me distinguish and locate an appropriate trusted source – an expert"

Dennis D. McDonald, excerpt from "Bringing Knowledge, Relationships and Experts Together"

What is referred here as an Instant Knowledge System, generally means a type of system to find people having knowledge in a problem domain. The problem of identifying people "who know something relevant" to the needs of information seeker is very relevant in an online Learning Network. Formally, a Learning Network is defined as an online network to support the learning needs of lifelong learners in a particular knowledge domain [1]. A Learning Network supports heterogeneous people of different age groups, expertise-levels and interest, to fulfill their learning goals. Learning Networks are meant for self-directed learners [2] who make their own learning plans, according to their learning needs, irrespective of place, time and pace of learning [3]. In such a Learning Network, very likely a learner would remain hidden from others even though s/he matches with others in common interests or knowledge. In particular, while performing a learning activity s/he needs to know about other learners who may provide her/him with support, advice or help. Research has shown that, learners' success or failure on a learning activity also depends on how well they are connected to other learners [4, 3]. In a situation where a learner searches for people, s/he needs to manually browse through the profiles or websites of individuals to get to know about others. It is a time taking and tedious job to manually browse through peoples profiles, especially in a large network of people. This also leads to increase the extraneous cognitive load [5], the efforts required by learner to gather information relevant for learning from disparate sources. A people-finding system in Learning Network would help to automatically search and suggest learners whom they match. Thus, we initiated research for designing and developing to find suitable others for a learner: a people-finding system, we call it as Social Support System (SoSuSy) in Learning Networks. In this paper we want to report about the approach we want to take, methods we want to use and the current state of work to develop a first prototype of SoSuSy.

II. PEOPLE FINDING AND RELATED SYSTEMS

People finding systems are a class of recommendation system meant to find a person who has knowledge on a specific problem domain [6]. There have been many efforts till date to realize such systems in locating people or expert [7, 8, 9, 10,

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11, 12, 13]. These systems use different techniques and have addressed different scenarios like answering a specific question, expert location for sharing advice, visualizing the competence of organizational groups etc. Typically, these systems use information from different range of sources like centrally held database of personnel skills [14], to systems that use real-time information held within the corporate system [15]. There has been development of people-finding systems that use an organization's common set of resources, including e-mails, phone books and peer-reviewed technical report repositories to identify the required expert [16]. Most of the expertise finding systems are system-centered since they use specially created data-bases containing people's profiles, maintained by the organizations. The problem associated with these profiles is that they are not updated regularly and people do not have a control on the content. With the advent of Web 2.0 and Social Software, people can bring in their content to the web using services like Blogs, social bookmarks, and social-tags (tag clouds) and they are able to build social ties globally with ease using social software (facebook, linkedIn, myspace etc.). Recent studies on the existing expertise finding systems have identified the need to focus attention on the user-generated content [17] and their social connections [18] to find experts. These information sources are publicly available and can help making open profile of people, showing their knowledge, expertise and interests. To address the limitations of previous studies and the avenues from the emerging web. We describe the basic conceptual model of our proposed system in the next section and suggest that by using the user-generated content (blog-posts, social-bookmarking and social-tagging), we can find people's interests on a given topic. We also like to analyze their existing social connections as an evidence to select suitable people in recommending a learner. With such recommendation service our intention remains in connecting people in a Learning Network to increase social capital, thereby increasing the productivity of learners by supporting interaction with others.

III. BASIC CONCEPTUAL MODEL

A. Main Idea

We attempt to design, develop and test a software prototype called Social Support System (SoSuSy) for the lifelong learners in the Learning Networks, (for general overviews please refer to our previous published work [19]). A system to find suitable people when the questions like "Who should I ask?" arises in a learner's mind. This research is an extension to the research efforts of providing a generic social help in an online community, similar to the expert finding systems in an organization, multi-agents learning support or virtual help assistants as reported in previous section.

B. Social Support System (SoSuSy)

In the current work, we are not only interested in experts search but also in any learner who is knowledgeable enough to help another learner on a particular question. We assume as a pre-condition, that people maintain their web presence by write about their interests (blogging), sharing bookmarks (tagging) and having social contacts (social network). They maintain the information online and let it accessible publicly. The advantage of open information is that anyone can reflect his interests (by using tags to associate with a concept, or social book-marking) and knowledge (blogging about a certain topic). By taking this information into account, search can be made to show fellow learners who might be suitable for giving a help request. A SoSuSy in Learning Networks would be an added value for a learner to know about people and decide whom to and how to interact with them. It will provide several benefits to a learner:

- A learner could connect and make social ties with other learners either for question in hand or for future contact in similar context.
- It is possible that in connecting people to other people, one can share and exchange expertise about the information which is not documented like people's experiences (tacit knowledge) and interests. A learner could share with others different perspectives on a topic, comparing and constructing meaning, which would lead to effective learning for her/him.
- A learner would not only depend on experts but s/he can seek help from any suitable person available in the Learning Network, where people with different levels of expertise exist.

C. Web 2.0 content as a source for finding people

The current internet provides several tools and applications (Web 2.0 applications), that make it easier for people to bring in their content to the internet. People in a Learning Network may already have online public information about their interests, skills, competence or knowledge, such information can be written as a free-text description on their web page, they might also write blog-posts which are then tagged to particular concepts and can be viewed as tag-clouds that indicate their interests. For example, people can write about their experience on "Scuba diving" and tag it with "diving" "underwater" etc, they can bookmark all the resources related to "diving". Such sources of information like bookmarks of interest, writings in the form of blog-posts, shows interests in the particular knowledge domain.

The user-generated content can be created in different forms like texts, videos, audios, pictures, documents. These are dynamic content (regularly updated) and provide latest information about people, like their working context, interests, knowledge, expertise and ideas. This information about people is relevant to suggest who is associated with which topic. The Social Support System will use the user-generated content which is a bottom-up information source about people, facilitated by Web 2.0 applications like web-logs (Blogs), wikis and social book-marking tags etc. There are several reasons to consider the user-generated content. First, as the use Web 2.0 applications are getting popular, it has become easier for people to maintain online information. People can write what

they think about particular issues using Blog services (wordpress, blogger etc.) and categorize (by tagging) the Blog posts using keywords, bookmark their interests using social bookmarking services (furl, delicious etc.) and manage their social contacts (friends or colleagues) using social networking sites (facebook, linkedIn etc.). These sources of information are useful to make an open profile about people based on their interests, knowledge and competence on a particular topic. This information is valuable in addition to the evidence of people's competence formally stored in ePortfolios or in organizational records. Second, people need not be enforced by organization to follow strict structure to organize their personal profile, cases where information about people is maintained as log data in organizational repositories. Third, profiles maintained within organizational repositories do not always reflect people's knowledge and current interests, they become obsolete with time. Fourth, even when a new learner enters a Learning Network, s/he may already have existing information (blogs, bookmarks and social contacts). So we do not only depend on learner's information maintained during learning (e.g. completion of learning activities in a Learning Network) but we can make use of personally generated information (blogs, bookmarks and social contacts) about learners that reflect their learning achievements, knowledge, competence and interests performed before even joining a Learning Network. The challenge is how we can use the information from Blogs and tags to prototype a system for recommending suitable people to a learner in a Learning Network. We detail the process involved in identifying people to recommend to a learner. The process consists of three inter-related sub-process as follows:

For a given question of a learner to find people on a given topic:

1. We need to find the sources of information, which are relevant to the question. We call them key-concepts, represented by a set C.

2. We need to find people who use tags to associate with these key-concepts. This can be known by analyzing contents, namely; (a) People create their own content, e.g., by blogging. (b) People show interests in others content, e.g., by bookmarking.

3. We need to rank each person based on their association with key-concepts and social connection. We could then modify the results based on the social distance between the learners.

Each of the aforementioned points can be further elaborated. First, key-concepts may be represented informally as tags, blogs tagged with keywords, and bookmarks tagged with keywords. Second, there are people who are associated with these key-concepts, because they frequently use tags or keywords. The association means that they may have interests, knowledge, or skills about such a key-concept. People can either create their own content by writing about it (blogging, publishing etc.), or show interests in others content by book-marking with social tagging (e.g, del.icio.us). Third, social connection between people could provide information about people's network. Social connection could be based on friendship, co-working, partnership etc. Therefore, people who are socially connected and also working on a common topic may be recommended to a learner who are new to a topic. This description is illustrated in figure 1.

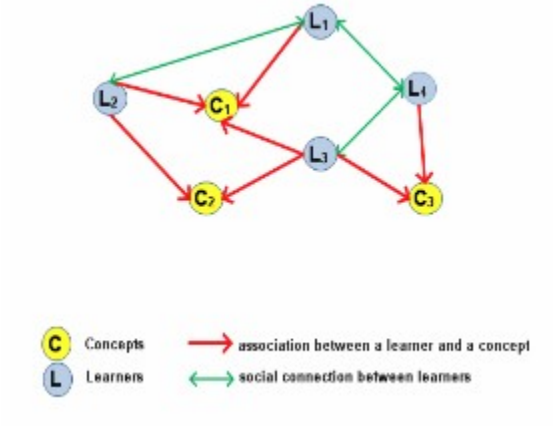

Figure 1. Associations between learners and concepts

In Fig. 1, learner L_1 is associated with the concept C_1 and has social ties with learners L_2 and L_4.

The bold (uni-directional) arrow indicates learners association with a given concept. They mean that the learners themselves make association (e.g. by using tags) with this particular concept. The bi-directional arrows indicate the social connections between the learners. A bi-directional arrow indicates that both learners are involved in getting in contact with each other by having common interests on a given topic (concept). Combining the three, namely; (a) key-concepts, (b) people's associated with key-concepts, and (c) social connections between them as depicted in Fig. 1, we could derive a model in terms of a simple equation to recommend a suitable person in a Learning Network. The rank of each person could be then based on their association with a key-concept and their social ties with fellows on similar key-concepts. We can also assign weights to the association to determine to what extent people are interested in a given concept. This will also reflect their expertise on that particular concept. The following equation shows the dimension to consider for implementing Social Support System.

*Rank of person = key-concepts * people associated with key-concepts * peoples' social connection*

D. Method used for requirements analysis

As the current state of work, we are doing requirements analysis using the process of Concept Mapping [20]. Concept mapping is a process to describe ideas of an expert group of people on a given topic. Concept mapping process consists of: generation of statements by the experts (brainstorming); rating and sorting of statements; and interpretation of the concept

map (data analysis). While all three stages may be done in face-to-face sessions, in this study the first two stages were done by mail due to participants' busy schedules and different locations. All concept mapping analyses were accomplished using The Concept System© (Version 4.0.147, Concept Systems Incorporated, Ithaca, NY). The results are represented as concept in a visual form that represents the focus of experts (see Fig. 2). We considered it a useful method for requirements analysis for developing a conceptual framework of Social Support System. By using the Concept Mapping process we intend to get group opinion of experts on the distinct features of SoSuSy.

On the basis of research problem we selected a total of 11 different participants from 7 different countries across different continents. Each participant came from a variety of educational backgrounds, namely: computer sciences, business management, human resources, education sciences and journalism. The idea was to gather varied expert opinion on the topic of Social Support System, from a diverse group of people. An email invite was sent to each of the participants with the brief description of the requirements of social support systems in Learning Network. They were asked to think-aloud about the need for such a system in Learning Network that searches for people. They were given a trigger statement: "*What defines a good Social Support System in Learning Network*". The trigger statement helped them to generate statements about the features or characteristics, that they thought are necessary to develop such a system in Learning Network. After each participant has completed the task of sorting, the results of all the participants are combined. First, a similarity matrix was constructed that represented the relative similarity of participants' sorting statements, i.e the results of the sort for each person are put into a square matrix which has as many rows and columns as there are statements. The values of this matrix is either '1' or '0'. The value '1' indicates that the statements for that row and column were placed by that person together in a pile while a '0' indicates that they were not. Second, the individual sort matrices were added together to obtain a combined group similarity matrix which is considered as the relational structure of the conceptual domain because it provides information about how the participants grouped the statements. A high value in group matrix indicates that many of the participants put that pair of statements together and implies that the statements are conceptually similar in some way. This group similarity matrix was analyzed using non-metric multidimensional scaling analysis with a two-dimensional solution, which generated x and y coordinates in a two-dimensional space for each statement based on its mathematical similarity to other statements. Third, statements were combined into clusters using a hierarchical cluster analysis. The results of the hierarchical cluster analysis were superimposed on the multidimensional scaling results to create a map displaying the points graphically within each group, with polygonal boundaries surrounding the points in each cluster group. A hierarchical cluster analysis yields all possible cluster solutions, from each statement in its own cluster to all statements in one cluster.

E. Results

In Fig. 2, there are 10 different clusters shown, which depicts how they were grouped together by hierarchical cluster analysis [20]. The main point of interpretation of the cluster map is that all participants come to figure out well the interrelationships among the clustered statements. It is aimed that everyone in the group has a clear picture of the project through the concept map. The clusters shown are depicting the expert opinion on various features that a Social Support System should have with varied degree of importance (shown as multiple layers on each cluster).

We briefly list and explain the meaning of each of the 10 clusters as depicted in Fig. 2.

1. Technical features: Focusing the state-of-art technologies for development like web 2.0 applications and Social apps.

2. Showing search similarity: The feature focuses on the search options where people would like to know the search results similar to what they are looking for.

3. Visibility: The feature focuses on the how social help system provides visibility of learners in the Learning Network.

4. Business application: The social help system as a tool for collaboration for further interests and commercial interests among people.

5. Communication among learners: The tool supports effective sharing of knowledge among learners facilitating communication via email, instant messengers or phones.

6. Learning community and connection among varied people: The tool supports forming learning communities and enhancing communication among the participants.

7. Facilitating learning and engagement: The tool provides support for bringing people to engage on a learning task and enhance learning by social engagement.

8. Interface design: Easy to use features and user-interface to search for suitable people in a network of learners.

9. Effects on society: The overall effects on society as a useful feature for supporting learning by socialization.

10. Output and Solution execution: The feature focusing on additional support like finding not only people but also relevant learning resources, supporting external collaboration, other embedded support.

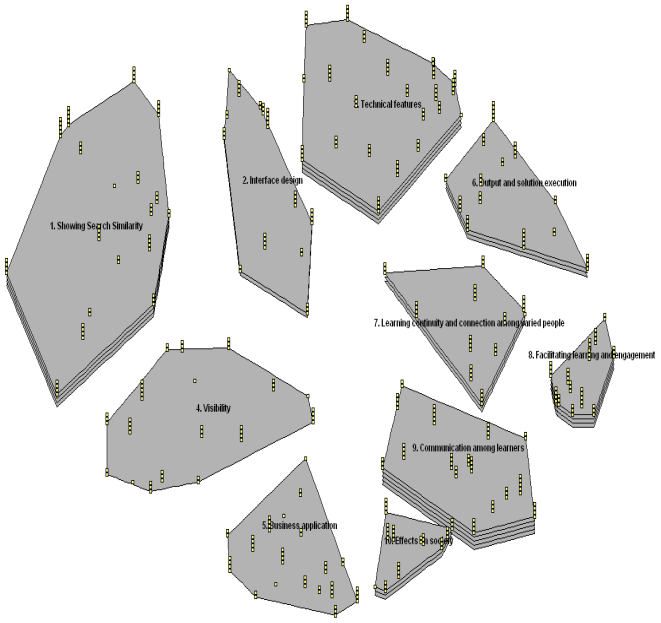

Figure 2. Cluster Map eliciting the focus on different required features of a social help system

IV. Discussion

Web 2.0 and Social Web provide the possibilities of exploiting the web to develop services for people recommendation in a Learning Network. The Social Support System plays the role of 'knowledge broker' to effectively moderate knowledge sharing between the members of a Learning Network. Social-support in the Learning Networks would give many benefits to a learner. First, the problem of isolation of learner in online Learning Network could be addressed by bringing a learner in contact with other learners. Second, a learner would not only depend on experts but s/he can seek help from any suitable person available in the heterogeneous Learning Networks. Third, it is possible that connecting people to other people, one can share and exchange expertise about the information which is not explicitly documented rather held by individuals, like peoples' experiences, interests and also tacit knowledge. To the best of our knowledge we claim that the use of expert Concept Mapping method is a novel approach in needs analysis of Social Support System. We will report on further results in consecutive papers.

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