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Kondratova, I., and Goldfarb, I.  
July 2005

\* published in the Proceedings of the International Conference on Computing in Civil Engineering 2005. Cancun, Mexico. July 11-15, 2005 . NRC 48239.

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# **ONLINE LEARNING OPPORTUNITIES PROVIDED BY THE ENGINEERING COMMUNITIES OF PRACTICE**

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## **ABSTRACT**

This paper examines learning opportunities provided by the online engineering communities of practice. These communities are communities of professionals and others, who share knowledge and resources using the Internet as a communication and collaboration channel and a shared virtual community space. The discussion in the paper is based on a recent study of design features and functionality of existing online professional communities of practice, and on the authors' experience in teaching and development of the computer-based learning resources. One of the models for a virtual community of practice that provides great means for knowledge sharing and collaboration is the "Knowledge Portal" model. This model fulfills the basic online community of practice portal requirements including online learning resources that support learning opportunities for the members of the community. The authors discuss several learning scenarios enabled by the online Knowledge Portal and demonstrate how online resources could be used in the Civil Engineering materials curriculum. Within the conclusion, the authors recommend some design features and useful functionality of the online communities of practice that facilitate lifelong learning by the members of the community and enable wide-ranging learning opportunities for students that are entering the professional engineering field.

## **KEY WORDS**

Professional community of practice, online learning, civil engineering curriculum

## **INTRODUCTION**

Communities of practice are communities of professionals and others who share knowledge and resources (Wengler, 1998). Hildreth et al. (2000) defines a community of practice as the community which has “a common set of interests to do something in common, is concerned with motivation, is self-generating, is self-selecting, is not necessarily co-located, and has a common set of interests motivated to a pattern of work not directed to it”. The key to a successful knowledge dissemination strategy within any professional community is to channel the knowledge directly to the community members, and at the same time, provide a means for information exchange and peer-to-peer collaboration (Wengler, 2000).

“Virtual communities of practice are physically distributed groups of individuals who participate in activities, share knowledge and expertise, and function as an independent network over an 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” (Allen et al, 2003). Thus, a virtual community of practice, as a rule, has some central features: such as members’ shared background and expertise, common language, common purpose and, most importantly, creation of new knowledge. These communities could also serve as learning environments for a wide range of users, including undergraduate and graduate university students and industry professionals.

## **COMMUNITY OF PRACTICE FUNCTIONALITY**

An online community has to satisfy three main objectives: supply content to the user, encourage members to participate in the community by contributing, and facilitate communication and interaction between community members (Pickles, 2003). In addition to the above, in the design of a virtual community space some functionality should be provided to “push” content to members. “There are a multitude of techniques for pushing content to and from members but the aim is for members to generate as much content between them as possible” (Pickles, 2003). These “push” functionality features of a community portal frequently include a Knowledge Repository, News, Workshops/E-learning modules, Classifieds and Job offerings. Other features serve a means of “pulling” content from members of online communities. Such “pull” features could include a Forum, Member directories, Member reviews, Polls and Surveys, Online and Offline events, as well as, providing Topic Experts services to the users. The rest of the Portal functionality features should be designed to encourage community members’ participation and collaboration. These features may include online conferencing, Forums, Chat rooms and Conferences, as well as live meetings. To investigate the most frequently used features and functionality for different categories of online communities, and, in particular, for professional online communities of practice, the study, described in the following sections of the paper, was conducted.

## **Study on Design Functionality of Online Communities**

This research study involved the evaluation of different online community portals through the collection and analysis of information about the design features and functionality of 30 community portal websites (Kondratova and Goldfarb, 2004). The following four community portal types were studied:

1. Business
2. Government and Organizational
3. Professional
4. Social

Within the study, a total of eleven professional community portals were evaluated. These communities represented a wide range of professional communities, including several communities of engineering professionals and scientific research communities. All online community portals were evaluated according to 80 different criteria arranged into the following categories, as suggested by the Knowledge Management for Communities of Practice Functional Requirements Matrix (USAID, 2004):

- Content: the knowledge repository and articles published on the community site
- Discussion Forum design and functionality
- Features: chat, news, e-newsletters, workshops, events, web-conferencing, etc.
- Tools and learning modules
- Search functionality
- Membership: Access to knowledge, tools, and collaboration by members and guests, how open this community was to outsiders, member directory
- Topic Experts as well as Moderator capabilities for forum and content submissions

Researchers performed evaluations based on the template evaluation forms developed for this study. The study results, for each online community portal, were entered into the template forms in the relational database. At the end of the evaluation phase, the study reports were produced for each portal category. The summary of the findings is presented in Figures 1 and 2. The complete description of the study and the study results was published elsewhere (Kondratova and Goldfarb, 2004).

## **Findings for the Professional Community Portals**

As mentioned previously, the techniques that are used to improve member engagement and participation in online communities, in order of increasingly

stimulating effect on member participation, range from “Pushing” content to members (content generated by the community Manager), to “Pulling” content from members (most of the content generated by community members), and, finally, to peer-peer content generation where content is generated by members for other members (for example in special interest groups, or sub-communities) (Pickles, 2003).

On this scale, as follows from the study results presented in Figures 1 and 2, we found that the professional community portals, out of the four online community types studied, encouraged the submission of documents and articles by members in to the repository the most, thus acting in both, the “pull” and the “push” content modes. The option to comment on articles was quite popular - about half of the professional community portals had this option. On the contrary, the option to rank articles was not available. It is interesting to note that the professional community portals studied did not utilize the option to create sub-communities. The sub-community option allows community members to form special interests groups for peer-to-peer collaboration and content development. The Discussion Forum option was available in all professional portals studied, but, contrary to the business community portals, it was never designed as a listserv.

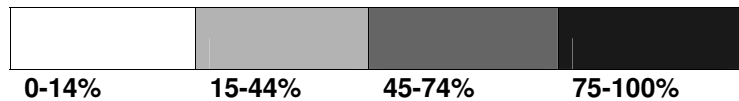
Other common features of the professional community portals, found in more than half of the eleven portals we studied, are described below. The portal repository was moderated and the members mostly had the option to submit and categorize content in the repository. The search option, for the professional community portals, was well developed and quite comprehensive. The search, among other features, included options to search for people, forum postings and documents in the repository. Community member directories were available for seven of the eleven professional community portals studied, sometimes with comprehensive member profiles that included the total number of documents submitted by the author and a picture or avatar of the member. “Topic Expert” functionality was also quite popular with the Professional community portals and frequently included the Expert directory and information on the field of expertise of the expert.

One of the most difficult parts of operating in a distributed community environment is to facilitate the evolution of the community and the development of the relationships. The case study conducted by Hildredth et al. (2000) confirmed the importance of maintaining face-to-face contacts for community building. Thus, offline events conducted by the community of practice can potentially become quite important for online community building. The results of our study showed that offline events were popular with less than half of the professional portals studied, revealing the missed opportunity for professional communities to maintain face-to-face contacts alongside with online contacts, as is done much more frequently in government/organizational communities.

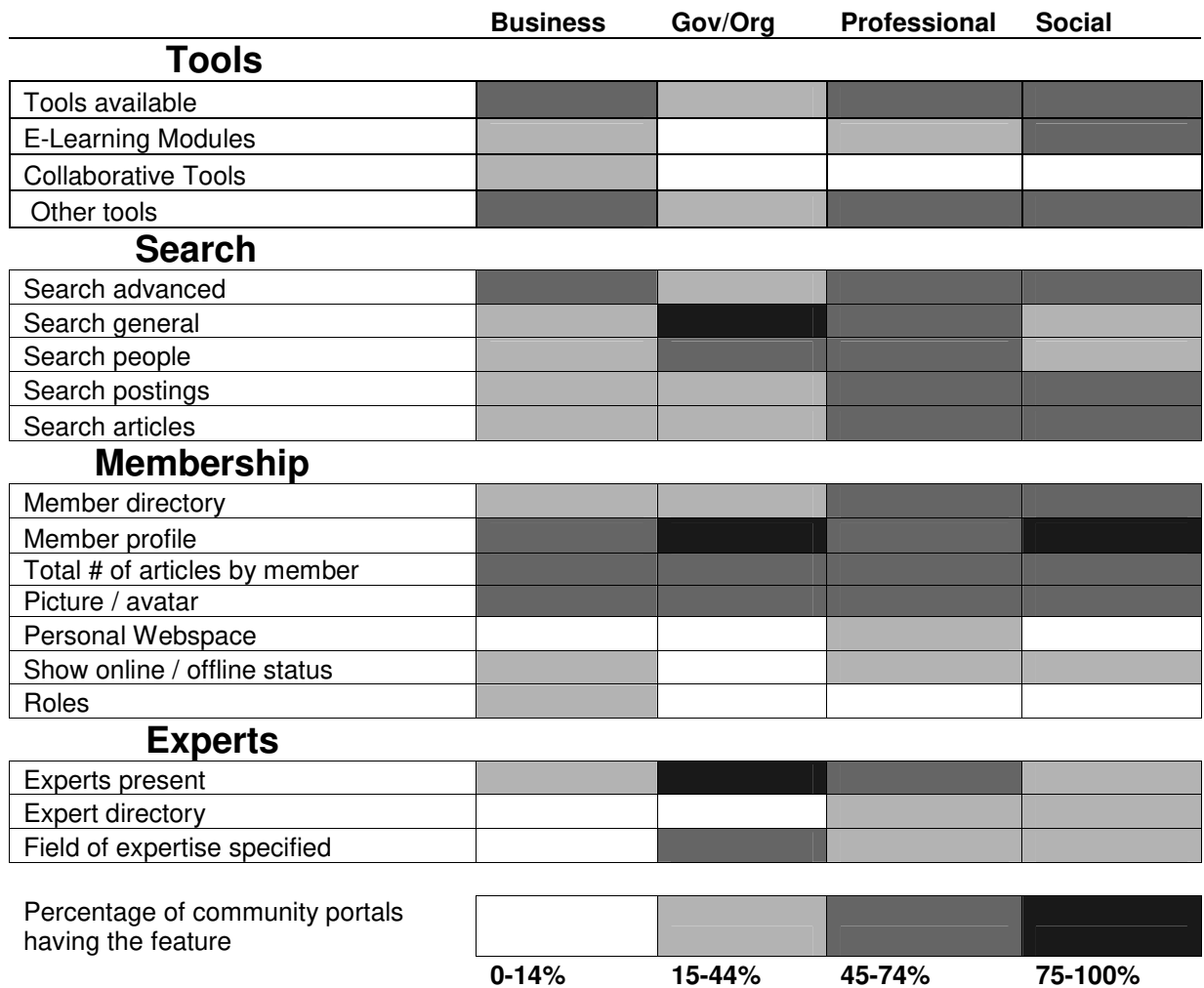
Online professional communities, out of all portal types studied, had the largest number of popular “feature” options available, including an events calendar, e-newsletter, recent news, workshops, job advertisements and software downloads.



Percentage of portals having the feature



**Figure 1: Content, Repository, Discussion Forum, Features and Tools**



**Figure 2: Search, Membership and Expert options**

In addition to this, only members of online professional communities had personal web space allocated for them. However, we found that “blogging” - ‘the art of using a personal web space for recording your own thoughts, ideas and experiences’ (Pickles, 2003) was not very popular for the professional communities portals, even though community members had a personal space available to record their thoughts. Surprisingly, out of all portal types studied, social community portals had the largest number of learning resources available (this might be the result of the fact that the majority of social portals studied were seniors’ portals).

In contrast to this, less than half of the professional portals had online learning materials available for community members.

The study of community portals highlighted best practices and the most common functionality and general features for the studied online professional communities of practice. The focus of this paper is on identifying the features and functionality of the



community portal that serve to enhance learning opportunities available for the community members.

## **LEARNING OPPORTUNITIES WITHIN THE ONLINE COMMUNITY**

Based on the authors' combined twelve years of experience in developing online learning materials, teaching online and being members of several online professional communities, we have identified several learning scenarios in the online community environment. The most prevalent learning scenarios for the professional community portal are presented in Figure 3. These scenarios are based on the Knowledge Portal model of the online professional community described elsewhere (Kondratova, Goldfarb, 2004).

The first option is to provide users with access to the dedicated online learning resources. Universities frequently use this option to provide online access to the entire engineering curriculum or to individual courses. Another option is to develop online learning materials (learning modules) related to a specific topic and to supplement them with some reference materials available on or off line. Learners can study this information on their own, and these modules could be incorporated in to the curriculum for a variety of educational institutions (Bremner, 2004). While the university-developed courses are normally only accessible to the university students (with only few exceptions), the online learning modules frequently have open access and are available to a broader learning community, including lifelong learners. Thus, the learning modules could serve as helpful resources for online professional communities. As mentioned previously, we found that the availability of learning modules within the professional community portals is quite limited, indicating a missed opportunity that should be further explored.

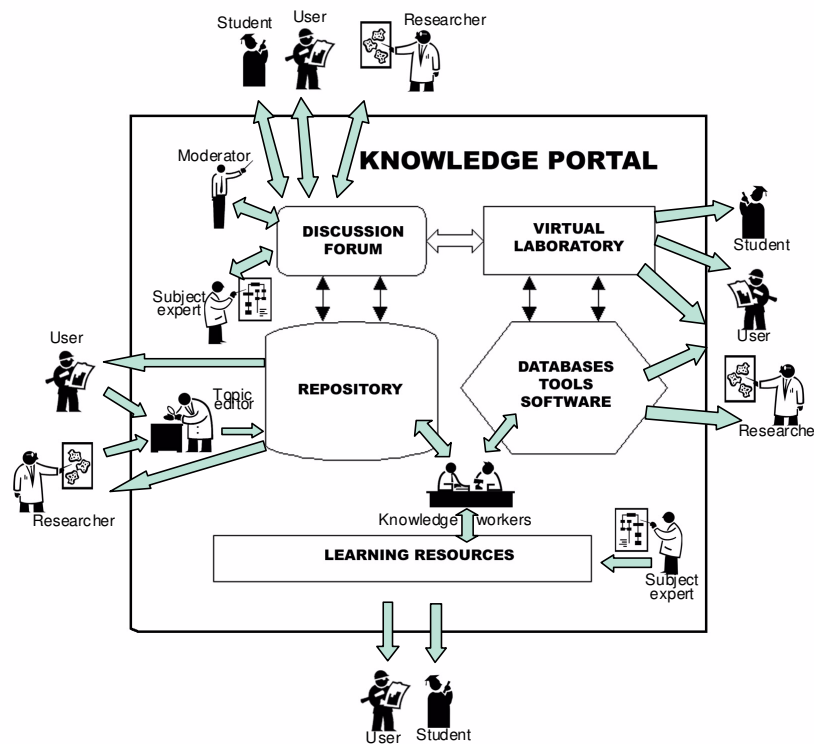
Learning by the community members could also be supported through the online Discussion Forum. The most straightforward way to use the forum, to acquire new knowledge, is by posting questions. However, as noticed by Powazek (2002), most people that visit the Discussion Forum are so-called "lurkers". "Lurkers" do not usually participate in the forum discussions, but follow them closely. For this silent majority of users, it is quite important to have a comprehensive search option available that allows searching the discussion forum content. We found that, frequently, forum participants could be quite annoyed by the newcomers asking common questions that were previously answered numerous times. To overcome this uncomfortable situation, it is advisable to equip the Discussion Forum with a comprehensive search option that allows for quick location of all discussion threads related to a particular question or topic. The results of our study indicate that a majority of professional community portals have these kinds of search facilities.

In addition to this, our experience, as members of professional community forums, shows that a supporting Glossary of Terms (available online within the forum or portal) could also serve as a valuable learning tool. Using the "Glossary" option, a newcomer or a member of the community can easily learn the basics of the topics discussed. This helps to understand, participate or follow forum discussions. The option of finding details about the author of the message is also quite important, as it

impacts on the credibility of the information and the credibility of the forum. It is interesting to note that among all types of community portals studied, we found that only professional community portals did not fully utilise this valuable feature with only than three quarters of the forums offering this option.

Databases, tools and software provided by the professional community portals could also serve as excellent sources of practical information. In certain cases this information has been collected for decades and is quite unique (US Army, 2004). Instructors could use this information for home assignments or in class. For example, the Database of the Concrete Long Term Exposure (US Army, 2004) was used, by one of the authors, for the Civil Engineering Materials course, in order to demonstrate the importance of using the proper amount of air in concrete subjected to freezing and thawing in a marine environment.

The information collected in the portal repository could also serve as a valuable learning source. It is crucial for this information to be credible; this is why we find the function of the topic editor or repository moderator to be so valuable and important (Kondratova and Goldfarb, 2004). However, in our study we found that, contrary to other communities studied, not all professional community portals utilize this option.



**Figure 3: Learning scenarios for an online community portal**

It is important to mention that it would be fruitless to direct students to use the tools and the repository within a professional community portal, if paid membership is required for full access. We believe that some provisions should be made by the

professional communities that would allow free or low cost access to the portal for student-members.

## **SCENARIOS FOR LEARNING WITHIN A COMMUNITY PORTAL**

This scenario is based on the learning opportunities provided by the Knowledge Portal represented in Figure 3. Within the discussion, we will be using the previously mentioned example of the Civil Engineering undergraduate course, and will discuss a case study based on the Civil Engineering Materials curriculum. The case study leads the instructor through the set of steps needed to fully utilize the community of practice resources for teaching purposes, including the following:

1. The instructor wants to fully engage students in a discovery process to utilize the learning potential of the portal. In class, the instructor asks students to find an answer to a question that is based on information not previously mentioned.
2. The instructor asks students to evaluate the future performance of certain concrete mixtures using the portal resources.
3. Students are asked to write an essay based, along with other sources, on the information contained in the Knowledge repository.

In the development of a curriculum for a course on construction materials, the instructor will utilize the portal's learning modules as a basis for topics studied in class, such as, for example, the use of supplementary cementing materials, and in particular, fly ash in concrete. The learning module on fly ash does not necessarily need to be physically located on the portal server, but rather it will be accessible through the link at its present location on the University of New Brunswick website (Bremner, 2004).

The assignment questions on the durability of certain types of concrete, in a specific environment, will be directed towards practical applications and students will be asked to find information using various online and offline sources, including the Discussion Forum, repository and the databases available through the portal. The instructor should emphasise the importance of getting credible answers to the questions asked. For example, if students post questions directly on the forum they should thoroughly check the credibility of the answers. They can do this by finding the information available on the author of the response. If the "Ask an Expert" option is used to find information, students should use the portal's "Expert directory" and expert ranking option, if available, in order to evaluate the credibility and the quality of the information obtained.

The instructor should advise students to first use the search option, within the forum, in order to find similar questions or discussion threads. In addition, students should be advised to use "Frequently used questions" or "Glossary of terms" sections to educate themselves on the basics, so that they can fully understand the responses they will receive. If the Knowledge repository is to be used as a source for writing an essay, it would be important to know if the repository is moderated by Topic Editors, as well as, whether the information on the author of the submission is available. Sources that contain the author's information should be preferred. For undergraduate

civil engineering students, it would be quite beneficial to use industrial and research databases or software tools, if available. In the case of the construction materials curriculum, the instructor could suggest, for example, using the database of the long-term marine concrete exposure (US Army, 2004). This database could also serve as a great source for an assignment on the durability of different types of concrete in a marine environment.

## **CONCLUSIONS**

In our paper we walked through several learning scenarios that could be used in order to expand the Civil Engineering curriculum, to include online resources available through the online communities of practice. The portal functionality, described in the paper, is based on the results of a pilot study. This pilot study is a first attempt to evaluate the use of particular design functionalities for online community spaces, in order to influence the level of member participation. As an outcome of this study, we developed a study template and a study procedure for studying community portal functionality; we evaluated the study procedure by conducting a pilot study of different community portals.

The limitation of this study is that some of the Professional and Government/Organizational community portals, that were studied, had a paid membership or membership by request option. Thus, information on the functionality of these types of portals was gathered based on the description of the portal's functionality posted to attract new members and was not experienced directly. For our future study program, a procedure that helps to overcome this limitation will be developed. Further in-depth testing of a large number of professional community portals is planned, in order to draw more precise conclusions on the functionality and design features used in these portals. This will allow the generation of better recommendations on how to improve the design and functionality of Professional community portals - to enhance member participation and knowledge sharing for online communities, as well as improve learning opportunities that are currently underutilized.

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