THE EDUCATIONAL ROLE OF COMMUNITIES OF PRACTICE IN BIOMEDICAL ENGINEERING

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Biomedicine is a very active research area. Biomedical industry is very demanding and, as a consequence, doctors and biomedical engineers must be always informed on the new technologies, devices and products.
The role of education in such active sectors is very difficult. The increasing needs for expertise, the inflation of existing knowledge and the limited time that engineers have for education and self improvement create the need for delivering the appropriate knowledge to the appropriate people in the minimum of time. Even open educational programs are insufficient to adapt and cover all emerging needs. The only viable solution seems to be education on demand. This can be supported by communities of practice, where the experts answer specific questions and provide valuable advices "on the spot". Additionally, communities increase the synergy among industry, practitioners and patients. Engineers share their knowledge with other colleagues, patients receive valuable consults and industry disseminates information on new products and devices thus promoting professional excellence of engineers.
This work summarizes the benefits from the development of communities of practice in biomedical engineering, explains their education role and discusses best practices and pitfalls that should be avoided.

Introduction

A vast amount of information is currently produced in Biomedical domain concerning methods, techniques and products. Institutes, companies and organizations work on the production and management of the accumulated knowledge in order to support individual researchers, practitioners and advance health and patient care.

The need for expertise and knowledge in all biomedical applications demands from engineers to get informed on recent advances in their fields and continuously improve their knowledge and methods. Usually engineers have to compress training and education into their valuable working time.

The delivering of the appropriate knowledge to the appropriate people in the minimum of time is the only way to balance this trade off between time for work and education. The results of this 'on the spot' approach will be in favour of professionals and their clients.

In most cases biomedical engineers have a specific field of expertise and persistently acquire new knowledge produced in this field. However, a lot of empirical knowledge is accumulated by everyday practice. This type of knowledge is not always documented in books, articles, conferences or informative material and is very difficult for new practitioners to find and use it. As a result, new engineers loose time in re-inventing the wheel, while they could get a quick solution from experts. Even when they attend seminars or training courses, they spend lot of time and get overwhelmed with abundant information that is difficult to digest.

This article introduces the concept of adapting the structure of Communities of Practice (CoP) in the biomedical domain. Wenger et al. [1], define communities of practice are "groups of people who share a concern, set of problems, or a passion about a topic and who deepen their knowledge and expertise by interacting on an ongoing basis." The output of this process is "a body of common knowledge, practices, and approaches", which is useful especially for new engineers to adapt and evolve.

The next section designates the importance of virtual communities of practice in companies and organizations scattered around the world.

Background

Although a community of people can be formed and survive without any external support, the use of technological advances is a necessity for modern communities. As stated in [2] community members are given tools to use their voice in a public and immediate way and form intimate relationships over time.

In his preliminary work [3], Wenger observed that COPs traditionally emerged through the mutual engagement in work performed by workers who were either physically co-located or who frequently met each other face-to-face.

The advent of network technologies spread the community members world wide and established a universal networking and collaborating environment. Consequently the communities of practice have been transformed into Electronic Networks of Practice [4] without radical changes in the main principles of collaboration and support.

Successful stories about communities of practice arrive from companies around the world, such as Shell, World Bank, and Xerox but also from organizations such as the American Health Information Management

Association - AHIMA [5] from the healthcare domain. However, all these communities have well defined borders and are supported and driven by trained staff.

The study of structure and operation of these communities is the first step towards establishing a successful community for biomedical engineers. The next step is to advance the practice and invent ways to promote participation, unity and member interconnectedness.

In the following section, we give a walkthrough for building a virtual community of practice and give useful hints on things to be done and other to be a avoided.

The DOs and DON'Ts for Success

The basis for a successful virtual community is the existence of a natural community between members. Natural community is defined in terms of common domain of interest, same targets and similar needs.

Our first concern when building a virtual community is to define the common targets and consequently to make them clear to all community members. Next we must decide on the services provided to the community members and define the organizational structure of the virtual community. The final step is to assemble all the required software tools and network technologies and offer them to our members through a common interface.

In order to increase the cohesiveness of the community we should start with a small 'seed' and expand it with care. This initial group of people should be characterized by commonality in their general interests and targets. In the same time members should differ in the level of expertise and in the specific interests and needs. The diversity in the level and field of expertise is an important factor that affects the interestingness and usefulness of the community to its members. Diversity increases interaction between members that exchange knowledge and support through the community.

Another factor that increases participation is the simplicity in the use of community services. New members are initially attracted by an easy to use interface and move to more advanced services only when they become accustomed to the community.

Members that are not familiar to the community can easily become disappointed by complicated services and leave, unless they have the proper support. Support is another important factor for a successful community. It can be established by providing informative material to members (online tutorials, manuals, frequent questions and answers etc.) and by assigning guidance roles to selected existing members (facilitators, moderators etc.).

The most important factor for the success of the CoP is to make members realize the business benefits of their network. A member should recognize potential gains from the community in order to participate and make full use of its services. The role of the administrators and moderators of the community is important towards this direction: they should be aware of the merits of using the community and continuously remind members about them. They should also motivate members to use the community by providing useful content, by setting up collaborative activities and socializing events.

The list of things to be avoided in virtual CoPs is equally long.

The complexity of structures and services is the first hinder. Knowledge management approaches that theoretically full exploit the amassed knowledge and make it available to members through 'smart' interfaces, in practice turn to be confusing for the members. A simple hierarchical directory of topics, a search facility and a short list of services is more than enough for most communities.

Another thing that should be avoided is to leave members without any support. The services and technologies only are not adequate to attract members. It is important to "make" users participate, without forcing them to.

Another obstacle that should be avoided is the broadening of the gap between experts and non-experts. Experts should assist members and provide useful advices, and in the same time train new experts that could share their tasks. Non-experts should be provided all the support needed to become experts, thus increasing the quality of the community. Consequently they should be assigned with new, more responsible roles inside the community.

The aforementioned list of best and worst practices cannot be complete and of course is not applicable in any community without changes. It is essential to analyze the specific needs, capabilities and ethics of a community before performing any of these steps.

In the case of biomedical CoP the content can be research papers or book chapters, news from the biomedical industry etc. The collaborative and social activities include open discussion forums, thematic conferences, virtual interdisciplinary teams of experts etc. Expertise may spring from various sources: industry, university, individual engineers etc.

As a consequence, tasks in biomedical CoP (i.e. administration, moderation, facilitation, etc) are accomplished by members from various disciplines.

In order to support the interaction of members in a CoP we need the appropriate tools and services. The following paragraph argues on the tools that facilitate a CoP and the way they are used in the terms of the community.

The tools

Tools to facilitate the involvement of engineers in a CoP include common Web-based dissemination and communication tools: e-mail, web pages, threaded discussion forums, chats, polls etc. as well as web-based collaboration tools that serve specific collaboration needs.

The role of the CoP is to use these tools in a way to facilitate member-to-member networking, including: the ability to share previously created knowledge (forms, sample policies and procedures, etc.), the ability to advertise and discuss new knowledge the ability to propose, lead, and disband communities as needed etc.

The next section illustrates the gains for individuals, companies, organizations and biomedical science in general.

The gains

A side role of communities apart from the education of doctors and engineers is the increase of synergy between companies, experts and clients. Engineers can join the community and share their knowledge with other colleagues. Communities also support the exchange of empirical knowledge which is more focused to patients' and doctors' needs than theoretical knowledge. Participation in forums allows patients to ask questions and doctors and engineers to increase the consultation time. Finally, when communities are open to the industry, they can receive information on new products and devices thus promoting professional excellence of engineers. The result is that community members will work smarter that harder, will communicate expertise to the new members and acquire maximum benefits. The benefits from the use of communities are the main motive behind the participation.

The benefits for engineers range from the alleviation of their everyday tasks to the development of their skills and professional profile.

The role of engineers in a CoP is to support community members. Professionals share their knowledge voluntarily with other members, invite new members and contribute on the expansion and guidance of the community. Active personal contributions to the community is a long-term investment and leads to recognition (awards, fellowships).

Through the community, engineers can be informed and trained on tools and techniques of their field of expertise. Training can be delivered by specialized institutes and lead to professional certifications

The community can be a vault to the career of engineers, as new job opportunities emerge from the professional network. The ability to remotely collaborate with other community members increases job flexibility (contingent workers, free-lancers etc.)

The benefits for the biomedical industry are mostly organizational and strategic. Firms have the ability to define key knowledge areas, and cover their needs for expertise by directly contacting engineers through the community. They can also define the strategic resources and the core competencies of biomedical industry and target research to this direction.

Organizational restructuring allows companies to expand their borders and to better organize and monitor the production lifecycle. They are able advertise their products easier and with minimum cost and increase their potential markets.

The gains for research institutes, universities and scientific organizations comprise: interaction with industry and consequently applied research, increase of basic research through the collaboration of researchers world-wide. Universities can act as focal points of the community of practice, by providing support and guidance to enterprises and education and training to engineers. Moreover, through the co-operation with industry, research increases funding and gains access to empirical data.

Conclusions

The article presents the basic concepts behind communities of practice and argues on their benefits for biomedical engineers, industry and research.

By following the suggested steps and avoiding the bad practices we mentioned it is feasible to build viable communities of practice for the biomedical domain. The benefits from the engagement in such communities are multi-folded. The increase of synergy, the faster information diffusion and the ability to focus on the actual people needs can boost the performance of scientific and professional organizations and individuals.

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