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About information practices in biomedicine

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The origins of this work, I suppose, was on the fourth floor of the main building of the National Public Health Institute (KTL) in Ruskeasuo, Helsinki. At the beginning of the 21st century, the department of molecular medicine was situated there. Still, I can see the long corridor in front of my eyes and the late professor Leena Palotie with Dr. Ismo Ulmanen having a vivid discussion about something that I had no idea of. Well, after that there certainly were many other incidents, which made me, the head of the information services of the institute to wonder, think and be curious about the work processes of biomedical researchers, their hidden "roadmap" to new biomedical information and knowledge. It seemed necessary to try to find out more about the nature of their work in order to be able to understand how the procedure during the research work moved on. With the understanding, I believed, it would be possible that the information related services could be subsumed within that process. Much later, I have realized that it really was important to try to understand, but even more important was to walk along the corridors of this highly respectable research institute and during the numerous incidents to discuss with various people. Without these occasions, this study would not have seen the light of day.

In the beginning, there was the observation - that may sound trivial here and now - considering that the information environment of the researchers in the molecular medicine consisted of something more than traditional articles and books. There seemed to be many other interesting information objects too. What these were precisely and what kind of role they had, this had to be figured out.

With the help of Dr. Marjo Kestilä, from KTL,

a survey form was designed where the researchers of the department of molecular medicine were asked among other things about tools and services, databases and information objects that they were using during their current research project. Later, we started to co-operate with professor Kalle Järvelin and his PhD student Sanna Kumpulainen from the University of Tampere. Together we were planning to be able to find a connection between the work tasks of the researchers and the information or data related tools and services they were using.

When the survey data was analyzed, the picture of the information environment was starting to brighten up. It consisted of data, literature, various tools and interpersonal communication. The number of the named databases and tools was huge. The amount of data and published literature was massive and it seemed that its growth was exponential. We learned that the most important literature database, PubMed, was integrated into various research databases. Articles were the most important published information resources. Over 91 % of the researchers were using data from databases during their current project. Researchers were using a great variety of tools and services in the analyses of the data.

It was noticed soon that to be able to say something about the use and the purpose of the use of the resources, additional information had to be collected. We decided to elucidate the collected data with interviews. From these, we discovered among other things that various resources were used simultaneously, in an interlaced way. After this stage, Sanna and Kalle continued their research into another direction.

Now we had a little bit more knowledge about the information environment and had some ideas about the research process in molecular medicine and even tasks that it involved. It seemed, however, that this was a description of the quite isolated phenomena of information seeking and use – often called information behavior.

In a book, edited by Karen E. Fisher, "Theories of Information behavior" 72 different models are presented. Supposedly, there are even more of them. The metatheoretical assumptions behind these models vary. Some of the models try to find general laws behind information related activities to be able to enable the prediction and explanation of particulars from the general, like is the case in the (natural) sciences. Some of the models start from the particulars, which on the other hand, is typical to the humanities.

The domain analytical approach forms an alternative view to the generalizing models, which try to identify similarities in patterns of seeking and use of information across the research domains. The tradition to study scholarly domains or disciplines in information science is actually fairly long. It is quite well known that information related activities between domains or fields vary. However, in many studies for example the use of information resources has been studied as an isolated entity and a deep understanding about the reason for the variation is missing.

In my thesis, I chose to use the concept of "information practices" instead of information behavior, knowing that it is not a neutral concept. Information practices mean a set of socially and culturally established activities to seek, use and share information and data available in different resources. Rather than to be based on individual motives, like inside born needs or ideas, information related activities are constituted socially and dialogically. The context of the information practices is not just a scattered background of the studied phenomenon but has to be approached in an interpretative way and understood as an inseparable part of the information practices.

How to approach the context? My presumption was that the understanding of the research process in the domain would be helpful in this purpose. Basing to this assumption, I wanted to know how the research work proceeds and in which way the information related practices in the biomedical domain are interlinked to the various stages of that work?

Cultural historical activity theory (shortly activity theory) seemed to provide an interesting and quite a novel theoretical frame, which appeared to promote the effort of setting the information practices in a broader context. Because

of this, I decided to supplement the earlier collected data with additional observations and interviews and analyze this all together once more through this theoretical lens. Later, more qualitative data was gathered from other fields of biomedicine and the focus of this research was widened also to clinical settings.

In activity theory, all activity of any subject is a purposeful interaction with the world. The unit of analysis is an activity system, which is seen in a network of other object oriented activity systems. Activity is mediated by cultural means, tools and symbols. It is also mediated socially by rules and the division of labor that regulate relationships between the individuals of the community.

When the research work in biomedicine was analyzed against this theoretical frame, it was possible to understand it as a chain of actions. In this chain of actions, certain stages of the work process seemed to be more information intensive than others, namely idea creation, the analysis of the results and the reporting. The most relevant information related actions in each information intensive stage were recognized. In this way, the information practices were placed in the broader context of the research work in molecular medicine.

One important observation was that the activity system of research work in molecular medicine was not an isolated entity. Various activity systems, like education, management and laboratory work, combine together a web of interrelated systems. Subjects (like junior/senior researchers, group leaders) are often involved simultaneously in diverse activity systems, which might have contradicting objects. Various subjects might have diverse motives or roles in various systems too. Because of this, it is possible that different actors have distinct needs for information.

From the survey, we knew that when searching literature, only a quarter of the researchers utilized library's services directly. This could be interpreted as an indication of a possible contradiction between the objects of the two interrelated activity systems, namely the activity system of the research work and the informa-

tion services producing activity system. It could be possible that when designing the tools, there was not sufficiently understanding about the activity system of the research work. Because of this, the tools did not fit with the researchers work processes, had no particular significance and went out or did not find their place within the process.

In the activity system of the research work, the information practices in general appeared as a tool, which had a mediating role between the subject/actor and the outcome of the activity in the net of the activity systems of the research work. In the hierarchy of the activities, information practices seemed to belong to the lower level of actions and operations and did not have a meaning of their own but were generated by the motive of the whole activity system. This does not mean, however, that information related activities would be meaningless to the research work. On the contrary, they may have an important role as an instrument, which is needed as an enabler, which on its part make the research work possible.

The activity theoretical research frame systematized and highlighted various elements that exist in the research work and was helpful in setting the information practices in a broader context.

From the point of view of the practical work, systems and services in the library, an important question is: does the domain make a difference? Is it possible to proceed the same way with all information actors and information or data in whatever domain? Does the domain or field matter?

Richard Whitley's theory of the social and intellectual organization of academic fields provided a stimulating alternative for the analysis of the characteristics of the scientific domain of biomedicine. For the first, my intention was to interpret Whitley's two key concepts, namely "mutual dependence" and "task uncertainty" in the biomedical field and find indicators that are related to these two dimensions. Secondly, the aim was to explore how these indicators are related to the information practices.

The degree of mutual dependence is related

to the extent of dependence on the previous produced knowledge in order to make a contribution to science. Task uncertainty on its part is related to the degree of predictability and visibility of the outcomes and the research processes.

It seemed that there were several indicators in the biomedical domain that showed low task uncertainty and high mutual dependence. Several patterns of work organization; a common goal for research, strong emphasis on research groups, clear division of labor and clear leadership and supervision were indicating about the low task uncertainty. It seemed also that the researchers were mutually highly dependent on each other. They were sharing local and global information and data resources, they were very dependent on new technologies to produce competitive research, they both collaborated and alike had a hard competition with each other. These factors were indicating the high mutual dependence between them.

When information practices were analyzed against these indicators, it brought up features, which helped to understand the specialty of the domain and requirements that these distinguishing features generate. Hard competition within the biomedical fields seemed to have an important effect. This appears to be one factor behind the explosion of data and publications, which is connected with the ways that information is searched, followed, used and produced. Easy to use literature and data searching tools, text and data mining tools as well as current awareness services are especially important in this highly competitive domain.

For many practical reasons, research culture in biomedicine has long been based on working in groups. This and the role of the group leader or principal investigator should be taken into consideration when information related services are developed and organized. It would be beneficial if the key person of the group were well aware about the tools and services that are available. This would make it easier for the other members of the group to be aware and take advantage of various devices.

A real challenge to biomedical researchers seems to be the publishing speed and hard competition of the domain. Every researcher, during the whole research process needs constant information about new research results. This has to be as integrated as possible to the neighboring activities and processes, occur as quickly as possible, and be as easy to use as possible. Last but not least, the results have to be accessible.

It seems, that there is a good reason to assume that the domain or field matters. To be able to help researchers to achieve the final object of their work, the domain specificity of tools and services should to be taken into account. If the tools are developed in isolation of the context of the research work, it is possible that these would not serve the intended purpose. - Even though they were excellent in themselves. - One practical option to the development of the tools is to attempt to do it in a close collaboration with the researchers, for example by using of the agile methods. Co-configuration and knotworking are methods developed by Yrjö Engeström and could be very helpful during the development of the services. These methods could bring researchers and information professionals closer to each other and enhance mutual understanding. Enhanced understanding would lead to better tools and services, which would help biomedical researchers to achieve their high quality goals in a more efficient way.