The Science of Team Science: An Emerging Context for Research in Human Information Behavior and Knowledge Management

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Introduction

This abstract describes a framework for examining the information behavior of teams engaged in scientific research and the use of this framework to develop knowledge management systems for the emerging discipline of the Science of Team Science (SciTS). Presented as a new area of study in 2006 (National Cancer Institute), the Science of Team Science promotes "team-based research through empirical examination of the processes by which scientific teams organize, communicate, and conduct research. The field is concerned with understanding and managing circumstances that facilitate or hinder the effectiveness of large-scale collaborative research, training, and translational initiatives." (Northwestern University, Clinical and Translational Sciences Institute website, 2010). Translational initiatives bring information developed by researchers to practitioners (National Institutes of Health, 2009). For example, translational medical teams bring the information discovered in research to doctors who apply the information in clinical trials. The growing importance of team, rather than individual research is related to the need for expensive laboratories and equipment as well as the multiple research perspectives and skills required for any given project. The shift to team-based research also is evidenced by the increasing number of patents obtained by teams and team-authored peer-reviewed articles (Wuchty, Jones, Uzzi, 2007). Another push for collaborative work comes from the United States government's preference for funding such work, so that researchers are strongly encouraged to form collaborations in order to obtain funding (Fiore, 2008).

Information is a primary need in team science. I suggest that this need is manifested through 1) the access, use, and reuse of information produced by individuals and the team for use by the team and 2) access to information produced by non-team members, but used by the team. The multidisciplinary nature of science teams requires the development and use of search terms that are understandable by all team members, regardless of their home discipline. Also, the nature of teams as temporary knowledge structures with members who move in and out of the team as needed, leaves the team susceptible to losing accumulated knowledge. Given this situation, knowledge management provides a useful methods managing information in the team.

Knowledge management

Knowledge management systems support organizational learning and memory by storing, retrieving, capturing, manipulating, and disseminating information. The system may be technical, with a focus on search engines or document handling systems, or socio-technical in nature, incorporating an understanding of social factors (Coakes, Willis et al. 2002; Katopol, 2007). This understanding is reflected in tools such as expertise lists, contact management systems, and workplace storytelling, which emphasize connections to other humans. Supporting research from a socio-technical perspective is Cognitive Work Analysis (CWA), a methodological framework focusing on the actor in his environment (Rasmussen, Pejtersen et al. 1994; Vicente 1999).

Using Cognitive Work Analysis

Previously employed in systems and human factors engineering, such as in the design of power plant controls, Cognitive Work Analysis is now applied to the design of information technologies and services (Fidel, R. & Pejtersen, A.M. 2004; Pettigrew, K., R. Fidel, et al. 2001). It is a multifaceted approach, allowing the researcher to observe the complexity of human information behavior in dynamic work environments. It considers that people at work exhibit information behaviors affected by organizational pressures that lead them to act in ways that are not directly responsive to the task at hand, but address some other need that must be filled (Katopol, 2006).

Central to the analysis is examining how people are affected by *constraints* - factors outside of their control and which shape behavior. For example, competition is an important element of science in the United States – competition for students, funding, publication rights, and prestige (Anderson, Ronning, De Vries, and Martinson, 2007). Students training for science careers may have information withheld from them because of institutional and professional forces that reward information hoarding (Vogeli, Yucel, Bendavid, Jones, Anderson, Louis, and Campbell, 2006). With these constraints on behavior, it is not surprising to find that scientists may not be eager to use systems designed to facilitate information sharing, even for sharing information within one's own team.

Using CWA, we learn *why* people do what they do when engaging in information behaviors, not only what they do. For example, a system designed to hold documents deposited by team members may fail because it does not address the need team members have to protect work in progress, obtain publisher clearances, protect future research streams, or consider commercial opportunities (Blumenthal, Campbell**,** Anderson, Causino and Louis, 1997). Once we learn the actor's constraints, it is more likely that the newly design system will be used because it reflects the team's contextual and organizational requirements. For example, an expansive expertise list with detailed information about a scientist's research area may be more useful for collaboration than a system requiring the scientist to upload notes on current projects or recent grant applications.

Reviewing the domains of cited journals and conference speakers, it appears that researchers working in the Science of Team Science tend to come from sociology, psychology, computer supported cooperative work, bioengineering, and computer science. While these disciplines can help inform our knowledge of team psychology, computing in a specific domain, and computing for collaborative work, they lack the depth of expertise in human information behavior offered by information science. Information science has a rich body of theory and empirical methods that support learning about information behavior in the variety of contexts in which team members may find themselves such as a scientist seeking information for his own work, a team member adding his expertise to the team project, or a professor mentor deciding which information to pass on to a new scientist. I suggest that the study of information use in team science would benefit from the expertise of human information behavior researchers and their use of an expansive framework such as Cognitive Work Analysis. Whatever their research perspective, by becoming an active part of the Science of Team Science, human information behavior researchers bring an expertise that is currently absent from this exciting and growing discipline.

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