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Information Seeking and Knowledge Organization

The presentation of a new book

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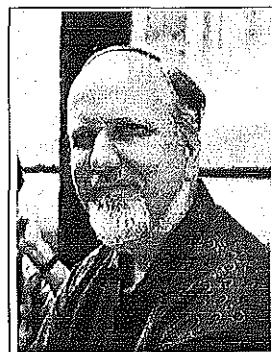
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ABSTRACT: Recently, a new book on knowledge organization has been published by Greenwood Press. The title is "Information seeking and subject representation: An activity-theoretical approach to information science". This book presents a new general theory for information science and knowledge organization, based on a theory of information seeking. The author is Dr. Birger Hjørland, Royal School of Library and Information Science. In 1994, he presented his work on theory for KO at the 3rd International ISKO conference in Copenhagen (Hjørland, 1994). The book aims to provide both a new understanding for the foundations of information science and knowledge organization, and to provide new directions in research and teaching within these fields. KO (Hanne Albrechtsen) has interviewed Birger Hjørland in Copenhagen about his views on knowledge organization and subject representation.



HAL: What is the role of knowledge organization (KO) in information science (IS), according to your view?

BH: Librarians often say, that library science is about information seeking and knowledge organization (KO), or that information science is about information storage and retrieval.

I do agree that both the seeking and the organization of knowledge and information are basic processes at the heart of IS. At the deepest level, however, I regard some special forms of information seeking as the object of IS. Knowledge organization is perhaps in practice the most important task to accomplish, but its purpose is to make it possible for the users to identify the most relevant knowledge. Therefore KO should support information seeking behavior, and a theory of information seeking behavior can form the basis of IS.

Searching behavior is a very broad range of activities performed by animals and humans in order to

identify resources of some kind. Disciplines studying human information seeking include parts of consumer studies, mass media studies, educational psychology, science studies and information science. Humans are of course often seeking very abstract resources such as better ways to program computers, to raise children or to understand art. Fig 1 (from my book, p. 14) presents a typology of human information seeking behavior. You can see from the below (figure 1), that I regard document retrieval as a crucial area for IS, and especially that kind of document retrieval, which aims at the identification of items with potentials of contributing to solve a problem (i.e., subject retrieval). It is central to the concept of subject searching that we are (a) dealing with searching for unknown documents or information sources, using content-related criteria, and (b) searching for documents which will contribute to clarifying a certain problem or satisfying a certain information need.

Fig 1

Typology of information searches

I. Non-documentary searches

A: Individual information seeking behavior
(e.g. locating a restaurant, gather mushrooms)

B: Collective organized information seeking
(e.g. finding new energy resources,
identifying ways to cure illness)

- 1) Primary research activities
- 2) Informal communications
- 3) "Fact retrieval"

II. Document seeking and -retrieval

A: Known item retrieval.

- 1) Verification of documents.
- 2) Searching supplementary information about an item (e.g. abstracts, reviews, price or location data for decision about obtaining the item).
- 3) Access to specific items in order to utilize the potential information in the document (reading or scanning).

B: Identification of unknown item(s).

- 1) Identification of items corresponding to certain *formal* attributes in documents (e.g. documents in specific languages, by specific publishers etc).
- 2) Subject retrieval: Identification of items with potentials of contributing to solve a problem or satisfy an information need.
 - a) searching for items with potentials for solving a concrete problem or a specific information need.
 - b) searching for items with potentials for contributing to a general understanding of a problem field or a non-specific information need.In either case, subject retrieval may be disciplinary or interdisciplinary.

Because human information seeking is a kind of human behavior, a theory that can explain that behavior runs into the basic problems of human psychology: how culture shapes both human needs and cognition. This is a contrast to animal psychology. Animals communicate by signals, not by documents, and animal behavior is not culturally determined in the way human behavior is. Psychology has always tried to build on both physiological and sociological information. For information science, I find that the more sociological/anthropological approaches in psychology are the most fruitful.

HAL: This raises the next question: How do you define the concept "document"?

BH: That is not as straightforward as it may seem. The concept seems related to the semiotic concept of "text". In my view, a document is an abstraction, which can only be understood in the context of the communicative practices, which it has been historically developed to support (such as scientific communication, religious communication, juridical communication and mass communication). Documents are prepared by humans to serve special communicative functions. The understanding of documents presumes an understanding of whom they are serving as pri-

mary, secondary or tertiary information channels, what other communication channels they compete with, how the social communication system is designed. Different kinds of "discourse communities" have developed unique kinds of documents to serve their needs, e.g., in music: Sheets of music; in geography: Maps and atlas; in law: Codes and bodies of law; in astronomy: Almanacs; in genealogy: Pedigrees and genealogical trees and in psychology: psychological tests. The design of documents reflects many kinds of developments, including developments in information technology. At the deepest level, however, they reflect basic theories about what they claim to communicate: knowledge. Theories of knowledge are the most fundamental theories in studying documents (as well as communication and information science in general).

HAL: What is in your view the present state of IS?

BH: First, it is important for me to state, that it is very difficult to identify any theoretical coherent work in IS and to establish a debate about the foundations of IS. A majority of so-called "information scientists" are not really scholars/scientist but are people working with information technology or with practical problems without any ambition to formulate

theoretical principles or seeking empirical justification for their decisions. The number of people trying to establish IS as a science is shockingly low. This has been pointed out by many commentators. Second, many studies in scientific communication, which were earlier an important foundation of the field, seem to a large degree to have been taken over by sociologists of science and other kinds of "science studies".

Information science needs a paradigm, if it is going to drive the development in information services. It should not just follow various tendencies in other sciences such as computer science or management. It is my hope, that activity theory as presented in my book can help to establish such a paradigm — or at least contribute to a renewal of the debate.

HAL: How do you look upon other theories in IS, such as the cognitive view, semiotics, and systems theory?

BH: About the *cognitive view*, I want to say that I regard cognitive processes as very important. Information science is concerned with how people are being informed and with the role of various information systems in the process of being informed. It is my claim that every theory of IS is built on some kind of view of cognition. But this is often implicit. It is not easy to see, for example, the relation between cognition and such works as e.g. Ranganathan's facet classification, Salton's automatic indexing, or bibliometric analysis. But in reality such approaches presuppose certain properties about language, concepts, and cognition in general (especially views related to kinds of subjectivity or objectivity of knowledge). What is important is to explicate the theoretical foundations and consequences of the various views. In my view "cognitive science" is one theory about cognition, related to "artificial intelligence" and the view of cognitive processes as software in the brain. There are more or less "hard" and "soft" versions of such cognitivism. "The cognitive view" (Ingwersen, 1992) represents an eclectic version, which is open towards hermeneutics and other ways to look at cognition. Activity theory is also called "the sociocognitive view" which indicates, that it is explicitly a *sociocultural view* of human cognition.

All approaches to information science implies basic postulates and properties about cognition, meaning, language and knowledge.

Semiotics (or semiology) is the study of signs. It is a multidisciplinary area grounded in linguistics, philosophy, psychology, and sociology. One of its founders, Ferdinand de Saussure defined semiology as "the study of the social life of the sign in society," but in reality, semiotics has seldom provided such a social analysis. A few textbooks and expositions of informa-

tion science are built on a theoretical framework imported from semiotics, for example, Liebenau and Backhouse (1990), Bøgh Andersen (1990), and Brier (1996). A very valuable semiotic dictionary (covering many concepts of relevance for information science) is Sebeok (1994). Information science can learn a lot from this last mentioned source, and one can say that because IS is concerned with language, codes, interpreters and meaning, IS must (or should) be a part of semiotics. In fact, it is almost a trivial statement to say that IS should be built on a semiotic frame of reference. This is a *underdetermined* theoretical statement. Within semiotics you can find the same basic assumptions as in the founding disciplines: for example, positivism, behaviorism, structuralism, cognitivism, pragmatism, and historical materialism. Semiotics incorporates very different schools of research in, say psychology. Semiotics is often done from positivistic or cognitivistic perspectives (for a critique of a cognitivist semiotics, see Petrilli, 1993). The most valuable contribution of semiotics is in my view tied to the pragmatic and realistic epistemology developed by Peirce, Dewey, Vygotsky and others. So, my conclusion is, that you may call me a semiotician, but that I would prefer the more precise label "activity theorists" which has a more specific approach to the study of signs, meaning, cognition etc.

Systems theory and systems view represent important improvements toward more holistic thinking, interests in how systems are managed and get feedback, and in introducing the teleological or goal-directed dimension in research. One problem is: what system are we talking about? A computer system? A human cognitive system? The library as a system? Or "language and discourse communities" as information processing systems? How are these systems related to each other? The other problem with systems theory is that it is important at a very fundamental level, but rather early, the abstract analysis of systems as systems seems to become empty. We need concrete, historical knowledge of kinds of systems, and this is not what systems theory is about. However, system-theoretical models of communication channels between producers and users of information have been a great inspiration for my work.

HAL: The subtitle of your book reads "an activity-theoretical approach to information science". What is "activity theory"?

BH: Activity theory is a psychological theory, as well as an anthropology, a view of man, and much related to philosophical pragmatism and scientific realism. It is partly developed by Russian psychologists such as L. S. Vygotsky and A. N. Leontiev, and partly American psychologists and philosophers, especially the philosophers Charles Sanders Peirce and

John Dewey. The epistemological point of departure has been summarized by Sarvimäki (1988,58-59): "(1) Man is primarily an actor, living and acting in the world. The world is both a bio-physical, a socio-cultural and a subjective world. (2) Living and acting in the world constitutes the a priori of human knowledge. (3) Since living and acting constitutes the a priori of knowledge, knowledge is constructed in such a way that an application of well constructed knowledge will directly or indirectly serve living and acting. (4) When knowledge becomes part of an acting system, it functions as an internal action determinant. (5) There is a continuous interaction between knowledge and action so that knowledge is created in and through action and so that experiences that the actor acquires through action influences subsequent action. (6) Value-knowledge, factual knowledge, and procedural knowledge are three types of knowledge connected to the three types of internal action determinants. Having value-knowledge means knowing what fulfills the criteria of good values. Having factual knowledge means having true beliefs about the world in which one is living. Having procedural knowledge means knowing how to carry out a specific act or act sequence. (7) Knowledge can be unarticulated or articulated. Unarticulated knowledge is, for instance, tacit knowledge, familiarity, knowledge by acquaintance. Knowledge can be articulated in everyday language, science and art."

Activity theory is related to epistemological historicism, which states, that knowledge is historically, socially and culturally determined; that concepts are not primarily defined from individual sensations or by eternal criteria, but from cultural learning and influence; that all experiences, even the most simple, only happen on the basis of an understanding of the coherence in which the phenomena form a part; that all experience happens from a certain perspective and in a certain historical and social context; that the individualistic account for the cognitive system provided by both empiricism and rationalism is seen as narrow-mindedness because they do not include the signification of the role of tradition and social communities for learning and conceptual development.

The function of knowledge and information is thus not only studied individualistically by focusing on the isolated and abstract human being, his or her ability to sense, remember, and form concepts, but by involving the whole person's developmental history, both individually and collectively. The individual is seen as a member of "discourse communities" or disciplines. Attention is also given to the study of what knowledge really performs and has earlier performed: the history of culture, ideas and science.

The emphasis on collective organizations such as scientific disciplines or knowledge domains in subject

analysis rather than on individually perceived "aboutness" or "topics" or rationalistic "forms of knowledge" represents an alternative to a dominating viewpoint represented in Library and Information Science.

HAL: Epistemology seems to be an important concept in activity theory?

BH: Yes, it is a theory very explicit about epistemological questions, and it is rather astonishing, how strong an influence basic epistemologies have in modern cognitive science as well as in IS and linguistics. In my view, because activity theory is not focusing so much on the physiological mechanisms in the human brain as other psychological theories, its explanation of information seeking is to a higher degree related to forms of thinking developed historically. The most basic forms of human cognition are related to basic epistemological theories such as classical empiricism, classical rationalism, and epistemological historicism. Thus, there are close relations between psychology and epistemology. However, most traditional psychology has psychologized epistemology very much, whereas activity theory, on the other hand, has provided psychology with an epistemological foundation.

Both classical empiricism and classical rationalism are "foundationalistic" theories, which mean that they think it is possible to formulate the basic principles on how to obtain knowledge, that knowledge is infallible. All knowledge develops in the individual human being (methodological individualism), and consists of elements (facts, modules) of infallible knowledge, which can be combined to larger units. Therefore, in principle, they see knowledge as modular.

It is important to state that these epistemological theories are still relevant and visible in much scientific thinking, and that analysis of epistemological issues takes place in different levels, e.g. both the way in which information science studies scientists information-seeking behavior and the way in which scientist themselves seek information.

Some basic principles in classical empiricism includes

- All knowledge originates from experiences (from the senses).
- All knowledge based on experience concerns something particular (isolated); empirical knowledge is therefore fragmented.
- The sensations of the individual human being are the basis for obtaining knowledge.
- Sensory experiences are private. Knowledge must therefore be subjective. (Subjective idealism)
- There is no point in speaking about some reality behind sense-impressions. Science must keep to the observed (the phenomena) and to observable connections between the phenomena (phenomenalism).
- Complex concepts must be defined from simple concepts, which refer to sense-impressions. (Associationism).
- Inductive conclusions are allowed under certain conditions. It is not allowed to operate with invisible or "theoretical quantities".
- Generalizations are problematic - according to the arguments put forward by Hume. This results in skepticism. Classical empiricism "does not carry enough luggage".

Some basic principles in classical rationalism includes

- Besides the pure logical principles - other general principles exists.
- Pure and isolated experience provides no knowledge. You have to carry aiding hypotheses or other fundamental assumptions in the luggage
- In every domain of knowledge, it is possible to organize the knowledge in axioms, definitions and theorems.
- It is the thinking of the separate individual human being and the sense of evidence, which forms the basis for the attainment of knowledge (methodological individualism)
- Simple (non-defined) concepts are concepts which cannot be defined from other concepts in interesting ways.
- Fundamental concepts are concepts which are indispensable to describe or explain a topic.
- Simple and fundamental concepts enter into some necessary relations to each other. These relations reflects basic principles of reason.
- The analysis of a arbitrary topic leads to a number of simple and fundamental concepts.
- Every concept can be organized in an all-embracing structure of concepts.
- The difference between simple and compound concepts is absolute. It is not just the case, that something is simple and something is compound when seen from a certain point of view (knowledge interest) or in a certain respect.
- Empirical experience can be used to check ideas on general connections. However, it is never decisive for the insight in these.
- You can never determine the content of a concept by the presentation of examples of that concept. On the contrary: every sensory recognition presupposes that the perceiving person already has certain concepts ("carries something in the luggage")
- An analytical statement is a statement, whose truth-value is logically established. To a rationalist, there exist necessary statements, which are not analytical. However, to an empiricist there is no necessity in the world, everything that happens is contingent.
- The predisposition to realize basic concepts that does not originate from experience must be inborn. It is our way to form concepts, which determines the essential connections between the things, we can learn.

HAL: Can you exemplify this relevance for Knowledge Organization?

BH: as shown in figure 2, the methods of classification are intimately tied to epistemological theories.

Fig. 2: Fundamental Methods of Classification

	Research Objects ("scientific classification")	Documents ("bibliographic classification")
Empiricism	Classification provided by statistical analysis (such as factor analysis) based on "resemblance". Examples: Classification of mental illness in psychiatry or kinds of intelligence in psychology based on statistical analysis of test scores.	Documents clustered on the basis of some kind of similarity, e.g. common terms or bibliographical coupling. Examples: "Atlas of science" & "research fronts in SCI", algorithms for information retrieval.
Rationalism	Classification based on logical divisions, e.g. classification of people in age-groups. Examples: Chomsky's analysis of deep structure in language & cognitive models of the mind in psychology	Facet analysis built on logical divisions and/or on "eternal and unchangeable categories" Examples: Ranganathan, BlissII & Langridge
Historicism	Classification based on natural development Example: The theory of evolution: Biological taxonomies	Systems based on the development of knowledge producing communities (the division of scientific labor) Example: That feature by the DDC that it distributes subjects by discipline
Pragmatism	Classification based on analysis of goals and consequences ("critical classification")	Systems built on critical analysis of the development and state of knowledge. Examples: Francis Bacon, The French Encyclopedists, Henry Bliss, the marxists etc.

In my opinion there exist three or four basic methods of knowledge organization, corresponding to the three basic epistemological views. For instance, a psychiatrist can classify mental illness using empirical methods, or rationalistic methods, or historical methods (or of course combinations). In the same way, a psychologist can classify forms of intelligence or mental capacities by using statistical analysis of test scores (empirical method), by using computer models (rationalistic methods) or by studying the social construction of the intelligence concept (historical method).

On another level, information scientists can use the same kinds of methods to organize documents, knowledge or information. They can use empirical methods, such as bibliometric linking, and produce maps such as "atlas of science". Or they can use ra-

tionalistic methods, such as developing facets or principles for logical division, or they can use historical methods such as the cultural bias in different systems.

The empirical and the rationalistic methods are often looked upon as being "neutral", "value-free", "strong" and "scientific", whereas historical methods are seen as the opposite. However, such methods can not be arbitrarily "chosen". There are important developments in the philosophy of science which must be incorporated in all serious research. Therefore epistemology and "science studies" are very central to research in general and to information science in particular. But often this kind of insight is ignored because some epistemologies are not used in an open or rational way, but as an ideology.

HAL: What consequences does this view imply for looking at the basic problems of information retrieval (IR)?

BH: Information retrieval (IR) is usually regarded as a "hard" and strong part of IS. However, Sparck Jones (1992, p. 684) finds that the general problem is highly intractable, and van Rijsbergen (1986, p. 194) points out that this field is in a crisis. The fundamental basis of all the previous work – including his own – is wrong because it has been based on the assumption that a formal notion of *meaning* is not required to solve the IR problems. (This demonstrates the need for a semantic theory: *database-semantics*).

Traditional theories in IR presuppose the concept of "match" and of *similarity* between a request (R) and a set of documents (S). However, there need not be any formal linguistic similarity between related documents – as citation indexing can demonstrate – and thus "match" is not necessarily an indication of subject relatedness. An exact match could imply that the research reported in a retrieved document would have already solved the problem Y (or the retrieved documents present obsolete views on the problem and miss current views). If X is a researcher this means that X has to formulate a new problem because Y has already been solved. This would not make X happy because it would indicate X had asked the wrong question. But when is a question wrong and when is it not?

This example shows that it is meaningless to look at R and S in isolation from each other. R has been developed in relation to S either (1) individually: X learns about S until he is able to formulate R. The ability to formulate questions is a matter of an adequate educational background; or (2) collectively: X contributes to S, and S and R are developing together in what Humberto Maturana and Winograd and Flores (1987) call "consensual domains." Here the ability to formulate questions is a matter of an adequate organization of the scientific cooperation: knowledge of each other's findings, concepts, communication channels, and so on.

This view of language and cognition shares with activity theory a functional, ecological perspective, in which there exists a mutual, phylogenetic, and ontogenetic structural coupling between individuals. It is opposed to the view that language and cognition are a collection of mechanisms in isolated users or a semantic coupling between linguistic and nonlinguistic stimuli which the organism encounters. This view is prevailing in the traditional formalist/structuralist/cognitivist view of language and cognition. If we transform the former view to information science, we can say that producers, users, information systems, and intermediaries are often developed in a mutual structural coupling in the same domain or epistemic

community and that their developments are mutually determined.

Activity theory is an holistic approach, taking its point of departure from the division of labor in society. Scientific disciplines and other forms of "thought and discourse communities" represent forms of this division of labor. These communities are seen as basic producers of "meaning". They develop disciplinary and interdisciplinary communicative practices, sub-languages, structures of documentation, primary, secondary and tertiary information services, etc.

IR is a subprocess in the cooperation between knowledge producers and users. It is a technique closely related to the secondary information systems, trying to utilize the various "subject access points" in databases, such as:

- words from titles
- words from abstracts
- descriptors
- identifiers
- classification codes
- subject headings
- cited references (in citation searching)
- words from the text itself (in full text searching)

The relative value of these different elements for information retrieval is one of the most fundamental problems in IR, which therefore can be reformulated as: How do we measure the informational value of different "subject access points" in databases (or in systems of connected databases)? This is closely related to theories of "meaning" and "semantics" and could be termed "database semantics".

According to the basic view formulated in my book, there exist different epistemological views, and each view *implies different* standards or ideals regarding the structure of documents. Thus a typical empiricist article reflects the development of the empiricist research tradition. Therefore, the theory of database semantics is also closely related to epistemology.

The relative value of such elements as abstracts, titles, references, etc. forms part of a much broader area than the artificial elements such as descriptors and classification symbols created by information professionals. The foundation of IS therefore lies in types of documents and structures in and between documents. Documents regarded in their functionality as information sources to user groups.

Subject analysis is seen as the intellectual or automated process of analyzing the subjects of a document (or an information source) and the subsequent expression of this analysis as subject representation data. A subject analysis implies an interpretation of the potential of the document (or other information entity) in relation to the knowledge interests of a given information system, and this analysis is undertaken in a

given historical, cultural, professional, and pragmatic context.

Classification systems and thesauri represent kinds of "IR-languages" and documents analyzed using such systems represent "organized knowledge". An "IR-language" is in fact itself a "decision-support-system" for the subject analysis. As such this system may of course be more or less adequate. In practice, subject analysis is often performed by library personnel using a given classification scheme, thesaurus or "IR-language" to express the result of the subject analysis. This "IR-language" can affect the subject analysis, and the world view of the librarian may be more or less explicitly guided by, or even conform with a specific classification scheme. The fact that the "IR-language" affects the subject analysis may have both positive and negative effects.

From the point of view of activity-theory, the analysis of the implicit or explicit epistemological assumptions in documents forms a central aspect of subject analysis. Subjects in themselves that are the object of subject analysis must thus be defined as the informative potentials of documents (or of other messages/information sources).

Information seeking on the individual level to a lesser or greater extent looks like a casual guessing process, but the frame for this process can be found on the level of the collective. The degree of "casualness" is based on the organization of the cooperation. Information seeking is a practical as well as theoretically uncertain process because it is based upon the assessment that unproblematic questions are exceptions, whereas the majority of, and the most important, information seeking questions belong to the problematic category where interpretation and uncertainty are the rule. The real problem in IR is that it is not the problem to identify documents, which have similarity with a question. Citation indexing has shown that documents without any formal linguistic resemblance may be relevant and retrievable. The fundamental problem in IR is to identify a set of documents, which with a reasonable degree of certainty entails the solution to a problem, as presently known by mankind. That is, the problem of information authority plays an important role in IR.

HAL: What are, according to your view, the principle limitations or uncertainties in IR?

BH: All the sciences produce knowledge. Or, rather, what they produce are knowledge claims. New points of view constantly change what is regarded as knowledge, what is valid, relevant and useful knowledge. New theories and methods construct new methods, new concepts and terminology, a more or less constructed reality. The fundamental uncertainty in IR is tied to the fundamental uncertainty

about what are the most relevant knowledge claims, methods, concepts, how they are related and so on.

HAL: Would you say that in subject analysis, it would be possible in practice or in an ideal situation to identify all important epistemological potentials of a given article or book?"

BH: No, that is of course impossible, and represents an ideal. The question can be paraphrased as follows: How do we get the best intellectual background to analyze the subject of a document. My answer to that question is 1) that subject expertise is required, but not enough 2) that epistemological analyses (theory of science/ knowledge) provide a broad and relevant knowledge of great relevance. It is extremely important to strengthen the education and research in epistemology and science studies in IS as well as outside IS; 3) subject analysis of a document is ultimately a political question: what kind of activities does the document want to strengthen, and, following a similar strain of thought, what kind of activities does the subject analysis want to strengthen.

The key to a general theory of information seeking therefore lies in an analysis of scientific organization from a theory of science and sociology of science perspective

HAL: How do you see the professional role of information specialists?

BH: At present, general information specialists mostly have their expertise in information technology and in formal rules and standards connected to information management. Subject specialists are more closely related to the study of the production, communication, and use of knowledge in specific areas (e.g., music librarianship). General information specialists are specialist in information sources at the most general level. Subject specialist at a middle level, and the users at the specific level. All kind of information specialists must apply a "top down" strategy: mapping the information resources from the level, at which they are standing.

The theoretical aspects of information science should be more connected to sociology of knowledge, to sociolinguistics, to epistemology and to sociocognitive approaches such as activity theory.

It is important, that information specialists formulate their knowledge, not just develop tacit knowledge. This can be done by strengthening the research and teaching aspects of the knowledge. It is important that information scientists produce courses, textbooks, guides, etc. of relevance to different target groups. If we claim, that we have a discipline with relevant knowledge, we must demonstrate our relevance by making courses for various user groups. In my opinion, such courses must be closely connected

to problems of research methodology and philosophy of science.

It would be strategically important if information specialists could win the bastion that consists of being responsible for well-functioning and respected courses for students, researchers and other users, where information seeking is integrated into a scientific or scholarly methodological context.

Notes

¹ There is more information about the book on the homepage of Greenwood Press:
<http://greenwood.titlenet.com:11125/cgi/getarec?gre0313298939>
and on the author's homepage
http://www.db.dk/nhs/bh/1997_inf_seeking.htm

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