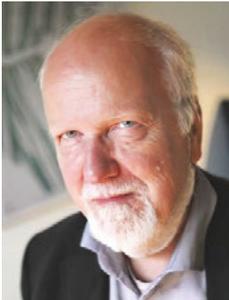


# Education in Knowledge Organization (KO)<sup>†</sup>

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**Abstract:** This article provides analyses, describes dilemmas, and suggests way forwards in the teaching of knowledge organization (KO). The general assumption of the article is that theoretical problems in KO must be the point of departure for teaching KO. Section 2 addresses the teaching of practical, applied and professional KO, focusing on learning about specific knowledge organization systems (KOS), specific standards, and specific methods for organizing knowledge, but provides arguments for not isolating these aspects from theoretical issues. Section 3 is about teaching theoretical and academic KO, in which the focus is on examining the bases on which KOSs and knowledge organization processes such as classifying and indexing are founded. This basically concerns concepts and conceptual relations and should not be based on prejudices about the superiority of either humans or computers for KO. Section 4 is about the study of education in KO, which is considered important because it is about how the field is monitoring itself and about how it should be shaping its own future. Section 5 is about the role of the *ISKO Encyclopedia of Knowledge Organization* in education of KO, emphasizing the need for an interdisciplinary source that may help improve the conceptual clarity in the field. The conclusion suggests some specific recommendations for curricula in KO based on the author's view of KO.

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## 1.0 Introduction

An educational program in knowledge organization (KO) at universities is often part of an education in information science (or library and information science, LIS), and has traditionally been considered at the core of the LIS curricula. KO may also be named "information organization"<sup>[1]</sup> or "knowledge representation"<sup>[2]</sup> and be related to, or involved in courses in "information architecture," information management, etc. (but probably not in courses in --> information retrieval, IR, which tend to be dominated by computer science).<sup>[3]</sup> One of the important issues to consider is the relation of KO to other fields. Looking at the landscape, a long range of specific fields/communities exists,<sup>[4]</sup> and a point here is that different people and teachers in KO tend to be more interested in some of these fields at the expense of other fields, and may see the future of KO

differently from other people. In addition to different communities and fields of learning, there are different approaches influenced by different philosophical views. In other words, there are centrifugal forces splitting the field, and any opinion about the future of KO is necessarily based on the author's knowledge, views and basic assumptions. This includes, of course, the present article.

Fundamentally, I assume the following relations:

Ontology/epistemology – theory of KO –  
working out specific KO-solutions

This formula states that all practical activities in KO depend on KO-theory, which in turn depends on philosophical assumptions. Specific KO solutions include making a specific knowledge organization system (KOS), making specific indexing of specific documents or making any other specific

application. To use another word, all such tasks are “theory-laden,”<sup>[5]</sup> which suggests that KO without theory does not exist (even if the theoretical issues mostly seem absent, are difficult to identify and even denied by leading scholars).<sup>[6]</sup> It also implies that any deeper understanding of KO issues must be based on KO theory, which in turn must be considered from ontological/epistemological perspectives. Different theories often have conflicting implications, but it demands proper theoretical training to discover them. Therefore, the present article aims to demonstrate the importance of theory in KO education.

It should be said that the author of the present article is also the editor-in-chief of *ISKO Encyclopedia of Knowledge Organization* (IEKO), presented in Section 5. IEKO is both intended to be a research resource and an educational resource. This article can therefore partly be understood as an attempt to establish an alignment between my views about education in KO and the philosophy behind IEKO.

KO programs may form parts of bachelor’s programs (BA), master’s programs (MA), and Ph.D. programs. (There are also other kinds of education, such as independent courses and continuing professional development, but these alternatives are not considered in this article, which focuses on educational programs contributing to define KO as a (sub)discipline and professional identity.) There are very large differences as for the length of such programs. Sellberg (1988, 30) reported that LIS MA programs are commonly one-year educational programs,<sup>[7]</sup> and Salaba (2000) found that although most ALA-accredited programs<sup>[8]</sup> require an introductory course in this area, not all of them offer courses beyond the required ones, which means that students have a limited exposure to the field. At the other end of the spectrum, some universities, for example in Copenhagen (where the author is affiliated, now as professor emeritus), have held courses at all three levels in the same program. This indicates a need for progression from more elementary teaching of KO at the BA level, to more advanced teaching at the MA level, to the highest level in the PhD programs<sup>[9]</sup> (five years education at BA and MA combined in addition to a possible PhD). This wide difference in lengths of study programs makes it difficult to talk about KO curricula in general and raises a question about defining the qualifications acquired at different levels of education in KO (and in LIS generally). The author’s background with comprehensive educational programs in KO has of course influenced the views expressed in this article.<sup>[10]</sup>

Education in KO (and studies of such educational programs) obviously depends on the answer to the question: “What is knowledge organization?” This issue of defining KO is not addressed directly in the present article, but Hider (2018) found that as a combined field KO is of recent --> origin, which formerly consisted of separate courses such as

cataloging, classification, and indexing. Readers may also be referred to my own IEKO article --> “Knowledge Organization” (Hjørland 2016b), and to the descriptive study of KO literature by Si, He and Liu (2022).

Concerning the nature of the field, it is important to realize that KO to a wide degree is a second level organization. For example, in KO Szostak (2020) developed the --> Basic Concepts Classification (BCC), which in 2021 changed its classification of flora and fauna to reflect the cladistics philosophy and methodology developed by biologists.<sup>[11]</sup> Therefore, this is an example of a second level organization, in relation to cladistics in biology. Classifications of, say birds, in bibliographic databases are generally based on knowledge about the classification of birds in ornithology, following what Bliss (1929, 16) called “the scientific and educational consensus.” The term *knowledge organization* includes the classification of “things” (or “phenomena”) (e.g., birds) as well as the organization of --> documents about those things.

This raises questions such as (1) to what degree does consensus exist in a given domain of knowledge; (2) how do we find out about the consensus, or alternatively about the most important views in the domain to be classified? (3) how do we deal with disagreements?

Whereas Bliss was convinced, that consensus exists and can be identified (even by himself alone), this is not the common opinion today, and already the contemporary philosopher Broadfield suggested (1946, 69-70):

Consensus is most likely to appear among the unenlightened, of whom it is characteristic to be unanimous on the truth of what is false. In intellectual matters agreement is rare, especially in live issue.

Today, the difficult, uncertain, and subjective nature of classification is often recognized, for example in biology.<sup>[12]</sup> To the degree that this view can be generalized, it means that educators in classification are faced with the problem that textbooks, manuals and other sources may be rather subjective. They are based on different traditions, classification approaches and technologies, and, to the degree that the writers of textbooks are confused, as Ghiselin (1997) suggested, we may expect everybody else to be the same, including teachers of classification. For information science and KO, this makes the situation difficult, as it forces us to be critical about available sources, and we need to consider the bases of classifications. With Ghiselin (1997, 180), we can say “our classifications need to be based upon something other than tradition, ignorance, and bad metaphysics”, an issue, which is further considered throughout this article.

I want to distinguish two dimensions in teaching KO: (1) the practical or professional knowledge<sup>[13]</sup> (2) the theoretical or academic knowledge, although these dimensions are in-

terrelated. While this article is basically an argument for the role of theory in practical tasks, I find it important to discuss this, because I feel it represents an important disagreement and dilemma for the field.<sup>[14]</sup> Szostak (2022, 263) wrote:

The goals of philosophy are quite different from the goals of KO. Philosophers have long sought precision in argument, and much of the debate in concept theory concerns whether concepts can be defined precisely. KO is a practical field and can thus be more relaxed: If people have a broadly shared understanding of a concept we can usefully apply that concept in our efforts to guide people to the information they seek. Philosophers have agonized over whether “freedom” can ever be precisely defined; libraries point users every day to books about freedom.

The dilemma, I see, is that in order to make proper contributions, KO scholars need to seek precision in argumentation, and we cannot pass over this demand by considering KO a practical field. Concerning Szostak’s example that users may easily find books about freedom, we still need to provide theoretical arguments for what distinguishes quality knowledge organization systems (KOS) from lesser solutions, and whether our classifications, -- > thesauri and -- > ontologies need to be based on well-defined concepts or not.<sup>[15]</sup>

Although the theory/practice issue is complex,<sup>[16]</sup> ideally there should be no conflict between these two dimensions (just as medical research, for example, is often immediately relevant for medical practice), and it seems difficult to justify research and theoretical teaching in KO if it has no practical importance. That said, there is often avoidance, if not anxiety, involved by examining the kinds of problems raised by theoretical research in KO,<sup>[17]</sup> and theoretical research may sometimes, rightly or wrongly, be considered relatively non-relevant by students, professionals and employers. This issue, of course, is itself important to address and may be deeply rooted in the history of the field, as expressed by Rehman and Alajmi (2017, 94):

As LIS professionals have often concentrated on applying new technology and standards, and they may not have seen their work as involving interpretation and analysis of meaning, library classification has been criticized for a lack of substantive intellectual content.

Therefore, the study of education in KO cannot avoid relating to different understandings of the field, of which the quote above expresses two hugely different understandings with fundamental importance for education in KO: (1) the

field of LIS does not involve interpretation and meaning but is mostly about applying technology and standards; (2) LIS must involve interpretation and meaning and should provide substantive intellectual content. Although the view that LIS does not involve interpretation and analysis of meaning is an unsustainable and unsubstantiated position, it has, as also said in the quote, been influential, if not the dominant one.

The present article tries to raise points of view, which may be used to frame further debates and studies about education in KO.

### 1. Teaching practical and professional knowledge organization

In practical, applied, and professional KO, the focus is on learning concrete<sup>[18]</sup> and procedural knowledge, such as concrete KOSs, concrete standards,<sup>[19]</sup> concrete methods for organizing knowledge etc.<sup>[20]</sup> A central question is, of course, which systems and methods? Saye (1987, 33) suggested that the essential elements in introductory cataloging courses were at that time:

- descriptive cataloging (emphasis upon monographs)
- access points (non-subject)
- heading work (non-subject)
- Dewey Decimal Classification
- Library of Congress Classification
- MARC format
- OCLC or equivalent (searching only)
- subject heading work
- filing
- treatment of nonbook materials”

Although this quote is 35 years old, and predates the Internet revolution, its core philosophy may still be influential in KO courses. As we shall argue below, a main problem in teaching KO, as I see it, is the clash between the systems used in practice, and the solutions suggested by research.

Professional organizations, such as the American Library Association (ALA) and the International Federation of Library Associations and Institutions (IFLA) often have policies concerning core competencies for professionals (e.g., ALA’s Committee on Education 2021 and ALA’s 2017 *Core Competencies for Cataloging and Metadata Professional Librarians*)<sup>[21]</sup> and Chu et al. (2022).<sup>[22]</sup> These policies do not, however, consider theoretical issues and dilemmas, and represent policy statements rather than research-based arguments.

Jeng (1993) discussed the necessity of a paradigm shift in the curriculum for education in “organization of information”<sup>[23]</sup> at that time. She described the traditional “cata-

logging paradigm” and its challenges and suggested a new paradigm for the (teaching of) organization of information, which preserves theories and principles from traditional library cataloging, its tools, and standards. The cataloging paradigm is built on the concepts and theories developed throughout the history of library cataloging as well as practical knowledge and skills of applying current standards and systems developed specifically for practice in cataloging.<sup>[24]</sup> She found that this paradigm was not challenged until recently (in 1993), but that it then met both practical and scholarly criticism (Jeng 1993, 115):

At the practical end, many practitioners, especially those in corporate firms and technological areas, feel that applying the traditional cataloging practices in organizing their collections is either too costly or inappropriate for their users, or both. They often choose to apply the knowledge of database construction and construct local databases for their collections using none of the current standards and systems of cataloging practice. Some of them follow no standard at all, while others produce their own subject authority lists or guidelines for database construction.<sup>[25]</sup>

At the scholarly end, many educators argue that the scope of organization of information in an LIS program is much wider than library cataloging. A core course for organization of information must not limit itself to library cataloging if it is designed to meet the challenge of information technology. A course for organization of information, many argue, should at least cover topics such as analysis and evaluation of information and data, classification and indexing theories, and principles of database construction and thesaurus construction.

Jeng (1993) suggested an alternative paradigm based on a broader and interdisciplinary perspective, but this alternative was not much developed.<sup>[26]</sup> It did not, for example, relate to other kinds of institutions such as archives and museums and failed to discuss the problem of domain specificity in the organization of knowledge.<sup>[27]</sup>

Now, much more than in 1993, we must realize that the classical library-oriented systems like the Dewey Decimal Classification (DDC),<sup>[28]</sup> the Library of Congress Classification (LCC), the Library of Congress Subject Headings (LCSH), the Universal Decimal Classification (UDC) and the -- > Colon Classification (CC) are challenged by developments in information technology and library administration.<sup>[29]</sup> For two reasons it is a problem if systems and processes used in practice are obsolete from a research perspective:

- (1) it may imply that research-based education is less relevant for practice because practice ignore new systems not in use;
- (2) it may imply that education reflecting current practices may not have a proper academic level and may be less relevant for tackling new developments.

Teaching practical knowledge about KO raises the question about which practices the education is aiming at: research-based education should improve practice and shape the future, not just reflect the present. An example is thesaurus construction, which, as discussed later in this Section 2, has good textbooks at its disposal and often seems popular among students. However, from the point of view of the semantic staircase,<sup>[30]</sup> thesauri may just be considered lesser ontologies (see Hjørland 2016a), and therefore less relevant to teach independently of this perspective.<sup>[31]</sup>

Developments in information technology may have positive as well as negative consequences for the teaching of KO. Miksa (1989) found that cataloging education in the beginning of the 20<sup>th</sup> century began with a focus on bibliographic system making as a total concept, but over the decades was narrowed to the idea of the preparation of entries. He quotes Cutter (1904, 5) claiming that “the golden age of cataloging is over and that the difficulties and discussions which have furnished an innocent pleasure to so many will interest them no more.” Miksa found, however, that times [1989] now have changed (*ibid.*, 292-3): “For the first time in decades, cataloging has gained the capacity of once again creating bibliographic systems in a way Cutter considered lost. In that respect, one would be justified in now asserting that the golden age of cataloging has reappeared.” Broughton (2010) pointed out the negative consequences for education in KO, because information technology has given rise to the assumption that KO is no longer necessary for information retrieval.<sup>[32]</sup>

Jeng (and with her much of the literature in library science) can be contrasted with a tendency in the information science literature, which relies less on traditions, but engages in studying the effectiveness of different systems and processes (e.g., by measuring “recall” and “precision”). This information science perspective is important to have as a basis for education in KO.<sup>[33]</sup> It is important to consider that KO normally serves information searching,<sup>[34]</sup> and that it is therefore important that people organizing knowledge in detail understand searching techniques and the relative roles of different -- > subject access points in searching (see Hjørland and Kylesbech Nielsen 2001). This means that courses in online searching are an important background for KO.<sup>[35]</sup>

Domain-specific KOSs such as -- > Physics Subject Headings (Smith 2020), -- > RILM Index (Henshaw and Wu 2021) and -- > STW Thesaurus for Economics (Kempff and Neubert 2016) have traditionally not played the same role as

the teaching of general systems.<sup>[36]</sup> This is probably caused by both lack of expertise for teaching such systems, and the feeling that, given the dominant structure of LIS education, it would be somewhat arbitrary which systems are taught (what is the idea in learning about KOSs in physics, if the students later get a job at a library for art studies?).<sup>[37]</sup> Although there are tendencies towards developing special fields, such as medical-, legal- and geographical informatics, these seem too little integrated with or part of general LIS departments and education. However, the idea that education in KO can avoid teaching domain-specific knowledge is based on problematic assumptions because one cannot construe or evaluate a general classification without being able to construe and evaluate its different parts. The DDC system, for example, which is the most used --> library classification system in the world, classifies biological species according to obsolete scientific knowledge (cf., Blake 2011<sup>[38]</sup>). If nobody in LIS has knowledge about, for example, biological classification, we are not able to update or use our systems properly and may even not realize that they are obsolete and represent faulty information. In other words, KO cannot claim to be a field about organizing and classifying knowledge and information unless it includes knowledge and principles about the specific as well as the general.<sup>[39]</sup>

In contrast to the classical library-oriented systems, contemporary KOSs include, for example, ontologies and linked data, and an important goal for education in KO should be to focus on such systems (although today they are dominated by computer scientists rather than by information scientists). Here we may distinguish the teaching of concrete, important ontologies (such as the Gene Ontology, GO) and the teaching of methods and tools for designing and editing ontologies.<sup>[40]</sup> Again, practical education tends to focus on learning concrete systems, such as the influential ontology editor Protégé, but it should be mentioned that, moving to the theoretical dimension, there is a need to examine the KO principles on which Protégé is based.

Morgan and Bawden (2006, 110) found that seven elements of knowledge organization (considered as both practical and theoretical) were the most appropriate to study:

- Abstracting
- Indexing
- Cataloging
- Classifying (including taxonomy and ontology)
- Internet Resource Description
- Metadata
- Thesauri

However, these elements have themselves been discussed as objects for studying in KO. Morgan and Bawden found, for example, that abstracting was the element that received the lowest interest among the respondents of their survey, all

other elements receiving much more interest. This is of course understandable, as the job of abstracting papers probably has disappeared from the LIS profession (if it has ever existed). However, from a theoretical point of view I have argued that the task of indexing a document presumes an overall understanding of that document (Lardera and Hjørland 2020). By implication the teaching of abstracting may, although not of direct practical relevance, provide relevant knowledge to improve the quality of indexing. The lesson here is that it may not be fruitful to teach too specific and narrow tasks, because their qualified completion requires a broader knowledge.

Another example concerns the description of Internet resources. Morgan and Bawden (2006, 114) wrote:

For newer elements of knowledge organization, such as internet resource description and metadata, there was still some uncertainty as to its place and its theoretical basis (if any). For this reason the importance ranking, especially for academics, was lower than for the traditional aspects.

Taken literally, this quote reflects a view that (1) there is no general theory of subject analysis, description, and indexing/classification of Internet documents (or documents in general), only of the documents having traditionally been considered in LIS education, and (2) that the theory for traditional KO is the thing we should go for. Both these assumptions seem problematic. (However, they probably reflect an understanding of Internet resource description based on some existing metadata systems, which are considered atheoretical.)

As a third example from Morgan and Bawden's list, we shall look at thesaurus construction as an example of teaching applied KO. Good educational tools exist, each of which provides a fine background for a course in thesaurus construction, and provides solid knowledge, which is essential for KO, but not sufficient.<sup>[41]</sup> The students learn about important semantic relationships between concepts (such as equivalence relationships/synonyms, hierarchical relationships, and associative relationships), but based on the common texts, the students are not taught concept theory or how to identify concept relations in a concrete subject literature. It is mostly left to common sense how concepts should be defined and their relations to other concepts determined.<sup>[42]</sup> (It seems a paradox that the field of KO, which is concerned with conceptual relations, has much confusion about its own concepts, e.g., whether *classification system* should be considered synonym with *taxonomy*.)

Let us look at a specific example: in her textbook on classification Broughton (2015, 7) provides some exercises. One of them is:

“Consider the following sets of concepts, and identify the odd one out in each,” followed by four examples, one of which is: “Paris Rome Idaho Cairo”. Thereafter: “I hope your answers will be:” Idaho (because it is not a capital city). [But Idaho is not a city at all, and for the sake of argument I’ll use instead the city Pocatello, which is not a capital city but the one in which Idaho State University is placed].<sup>[43]</sup>

This example implicitly reflects the view that conceptual relations are hardwired in the mind (or considers the ability to classify as an inborn human qualification or conceptual relations to be given a priori). We should rather argue like this: there is no “given” relatedness among concepts, such relations depend on the purpose of the classification. For example, which cities are considered related depends on the purpose of classifying cities, where, for example, people involved with climate crisis, might have a need for classifying cities according to how “green” they are (i.e., their “eco-credentials”) or by the nature of their ecological challenges. An example of classification of cities from the literature is the classification of Finnish cities by Yli-Jokipii (1972) according to statistical data about occupations into industrial cities, wholesale trade cities, retail trade cities, service cities, transport cities and construction cities (“city-role-typing”). These are just two alternatives for classifying cities into capital cities and non-capital cities (but to provide an alternative solution to Broughton’s example would require empirical studies of the four cities [Paris Rome Pocatello Cairo], which I have not done). The point here is that this kind of thinking is absent in the teaching materials mentioned about thesaurus construction and this absence supports the quote by Rehman and Alajmi in Section 1: “LIS professionals have often concentrated on applying new technology and standards, and they may not have seen their work as involving interpretation and analysis of meaning”.

Another issue related to teaching thesaurus construction is its status among other kinds of KOS, in particular ontologies. If a thesaurus is just one kind of KOS with fewer kinds of semantic relationships between concepts (as suggested by the earlier mentioned “the semantic staircase”), then a thesaurus could be understood as a rather arbitrarily limited kind of KOS. Instead of learning some relationships that are specific for thesauri, the students might be taught a broader range of semantic relations, and learn to put the question: which relations are most important to be specified for a given purpose? Faber and López Rodríguez (2012, 115) found, for example, that “non-hierarchical relations that define the goal, intended purpose, affordances, and result of the manipulation and use of an object (e.g. has\_function, affects, has\_result, etc.) are just as important as hierarchical ones, such as type\_of or part\_of.”

Two questions change education in KO in a fundamental way, demanding a more theoretical approach:

- (1) How do we decide whether a certain semantic relation between X and Y exists? Example: is Pluto a planet?<sup>[44]</sup> (semantic relations are not “context-free, definitional, and true in all possible worlds,” as it has been claimed, but they are discovered/constructed by research, and different paradigms may provide different answers, see Hjørland 2015a).
- (2) Which semantic relations are most important to specify for a given purpose in a given context (it has not been possible for me to find arguments for why thesauri have the kinds of semantic relations they have, and why other kinds of semantic relations are not included).

Such questions may demotivate those students who want to learn how to do things concretely with solutions that are not context-dependent. Practical issues such as those related to thesaurus construction are important, but for a field that claims to be academic, they are not sufficient. Hudon’s (2014) research seems to support this conclusion:

These results tend to reinforce observations made over the past 30 years in relation to KO and classification education. While KO and classification educators recognize the necessity for students to develop high-level analytic and evaluative skills, there are few references to those skills in current course objectives.

This indicates that most education in KO tends to remain at the practical level, rather than being informed by the theoretical level.

Considering practical and professional aspects for teaching KO, this Section 2 has provided arguments that it is problematic to neglect deeper theoretical issues in KO education.

## 2. Teaching theoretical and academic knowledge organization

In theoretical and academic knowledge, the focus is on examining the foundations on which KOSs and KO processes such as classifying and indexing are based. It is about the assumptions behind practical systems and processes, and about the criteria for distinguishing between good and bad systems and processes,<sup>[45]</sup> as well as about the qualifications, that make knowledge organization optimal (such assumptions are often implicit and require theoretical knowledge to explicate). Theoretical knowledge includes considering all the issues in practical and professional KO, such as concrete KOSs, concrete standards, concrete methods for organizing knowledge etc. We may repeat Ghiselin’s (1997, 180) quote:

“[O]ur classifications need to be based upon something other than tradition, ignorance, and bad metaphysics”.

Whereas practical work in KO may be constructing a classification system (or evaluating an existing one), in whole or in parts, or providing an update of a specific subject in a classification such as the DDC, academic work is about the examination of the bases for doing so. Such a task as creating or updating a classification does not itself meet the demands of academic work (it cannot, for example, qualify as a dissertation).<sup>[46]</sup> To qualify as a thesis in an academic program, the focus must be on the justification of the decisions made in constructing the classification (and only such a justification can document the quality of the classification). The best – if not the only – theoretically motivated of the general bibliographical systems is the *Bliss 2<sup>nd</sup> ed.* (BC2), which has both a general methodological volume and one for each domain classified, with rather developed methodological descriptions. Developing well motivated classifications based on such explicit theory (e.g., -- > facet analysis) probably should qualify as academic research proper, although academic work at the highest level presupposes considering the assumptions on which such a tradition is based and requires a stance on other approaches. Information specialists often consider themselves as experts in classification,<sup>[47]</sup> but it is extremely important that we consider classification an interdisciplinary field and include the contributions of other fields in our studies. An important point is that theoretical work should ideally provide operational procedures on, for example, how to make classification systems, how to do subject analysis, and how to attribute particular items to certain classes. Often the classifiers perform such processes based on their common sense and sporadic orientation in the domain to be classified, but in my opinion, this cannot qualify as academic work in KO as a scholarly field.

In Section 1, the following connections were claimed:

Ontology/epistemology – theory of KO –  
working out specific KO-solutions

Here, four basic, conflicting epistemological<sup>[48]</sup> views are briefly introduced in relation to KO. In Hjørland (2017a, Section 4.2c), I suggested four basic approaches to knowledge organization:

Rationalist theories of indexing and classification (such as Ranganathan's theory, BC2, the facet-analytic approach and probably much theory behind ontology construction) suggest that subjects are logically constructed from a fundamental set of categories. The basic method of subject analysis is then "analytic-synthetic", to isolate a set of basic categories (=analysis) and then to construct the subject of any given document by combining those

categories according to some rules (=synthesis). As the methodological principles of, say, BC2, do not include empirical principles on how to obtain the concepts to be organized, formally they are based on a priori principles (although in practice some kinds of empirical procedure have to be used, though not described in the methodology).

Empiricist theories of indexing and classification (such as many statistical approaches / numerical statistical procedures) are based on the idea that similar (informational) objects share many properties. Objects may be classified according to those properties ("overall similarity"), but this should be based on neutral criteria, not on the selection of properties from theoretical points of view because this introduces a kind of subjective criteria, which is not approved by empiricism.

Historicist approaches to classification are based on the view of the historicity of both (1) the object classified and (2) the subject doing the classification.

Concerning 1, to say that two elements belong to the same class (or "clade") if they share a common ancestor is clearly different from defining membership of a class by similarity (sets of characteristics as arranged by logical division or numerical taxonomy). This principle was famously stated by Darwin (1859, 420): "all true classification is genealogical". Today such -- > genealogical classification (Gnoli 2018) is dominant in most of biology as well as in other fields, including linguistics.

Concerning 2, historicist approaches are also based on considering the traditions and paradigms influencing the classifiers. This means that the construction of a classification cannot be done independently from considering different paradigms in the field classified, therefore criteria for classification are influenced by different cultural and historical norms. Ørom's (2003) article on -- > art studies may serve as an example.

Pragmatic / critical approaches to classification are based on considering the functions, goals, values, interests, policies, and consequences of classification. From this perspective, a classification can never be neutral, but will always tend to support certain goals and interests at the expense of other interests. Acts serve human goals. Libraries and information services and classifications also serve human goals, and therefore their indexing should be done in a way that supports their goals. Classifications based on this approach are constructed to support explicit interests. Feminist criticism of traditional classifications and feminist attempts to construe alternatives are an example of this approach, but in a way, it is a broader tendency in much scholarly work.<sup>[49]</sup>

Today we have both human-based controlled vocabularies (CVs) and free-text searching with no CV. There has been re-

search about this, but this has mostly been done without examining the quality of the CV and of the indexing. It seems unlikely that CVs can be justified in general, but likely that they sometimes can. Therefore, the relevant research question is: under which conditions can the use of CVs be justified? A related issue concerns human versus computer-based solutions. Both traditional bibliographical records and Internet search engines provide possibilities for limiting searches to, for example, documents in a given language. It should be possible to evaluate the relative quality of human versus computer determination of the language of documents (e.g., to compare MEDLINE with Google Scholar on this point). If the computer is superior for this task, it should be left to the computers<sup>[50]</sup> – and all other information in bibliographical records should be examined in similar ways.

Curricula in KO should therefore not be based on preformed assumptions about either human-based or computer-based systems and processes, but should illuminate the problems from a research-based perspective — realizing that research often is inconclusive and itself based on assumptions.

### 3. Studying education in knowledge organization

The study of education in KO is important because it is about how the field is monitoring itself and about how it should be shaping its own future. Such a study should be based on empirical knowledge on contemporary educational programs, as well as on historical backgrounds, trends in the development of educational programs, and visions for the future based on broad interdisciplinary knowledge. Such studies could benefit from historical perspectives, including background developments in both the systems used in libraries and developments in KO theory.<sup>[51]</sup> It would be fine having different examples of course plans, interviews with those designing the course plans about their priorities and how they have changed over time. Perhaps even interviews with head of departments and other stakeholders.<sup>[52]</sup> As expressed by a former editor of *Knowledge Organization*, Gilreath (1997, 135):

As one starting point, it would be interesting for ISKO members to know more about what kinds of educational approaches exist today in knowledge organization. Educators could have a chance to exchange ideas about how to teach KO, and members in general would get an impression of what is going on at the educational institutions involved. To our knowledge, there are very different traditions internationally, and even at national levels, and we believe it would be fascinating to publish a series of articles and shorter reports (including syllabi, etc.) on such activities.

It would also be fine to identify new Ph.D. theses in the field of KO (perhaps even selected dissertations on lower levels) and have them listed somewhere to get an impression on directions in the development of the field.

Studies of textbooks in KO are relevant because such books contain suggestions for the contents of educational programs. Studies should also consider the educational developments in the broader field of information science/library and information science (which has the dedicated journal *Education for Information*), which again should be considered in relation to developments in cultural mediation, information technology and other overall developments in society. It would be useful to know which textbooks are (and have been) most popular, and to have studies of them including how they have been reviewed.

Alajmi and Rehman (2016, 414) summarized former studies on education in KO:

In their evaluation of current KO curricula, Hudon and Guitard [2013] investigated course objectives in KO and classification courses, and noted that teaching and learning objectives tended to be very general, with a clearly dominant theoretical focus. Few objectives focused specifically on the complex process of analyzing subjects or on the new types of skills required to work with classification structures available in digital form. Pattuelli [2010] examined 2,000 course readings from introductory-level KO courses from 34 LIS schools in the United States and Canada. Results indicated that traditional bibliographic methods and practices remained at the core of KO courses. Their study also showed that metadata had become a central component of course content and that new topics in information architecture, covering markup languages and the semantic web, had been added. While U.S. programs continue to offer and require introductory courses in cataloging and bibliographic control, they rely heavily on introductory courses that focus only on cataloging education [Davis 2004].

Studies of KO curricula as well as KO textbook should ideally include theoretic and philosophical analysis, such as examining whether courses are based on explicit theories and whether they contain any possible non-recognized contradictions. Therefore, the argument of the present article for theoretical knowledge is also a relevant prerequisite for studying KO education. The study of education in knowledge organization must also consider the historicist and pragmatic perspectives, that is how different paradigms in KO and LIS influence the educational programs and the different goals and values on which educational programs should be based. Too few people have broad and deep knowledge on the field of LIS, but such broad knowledge is necessary

if educational programs should be based on solid knowledge and the choice of optimal solutions, and not just on hasty, ad hoc solutions.

#### 4. The role of *ISKO Encyclopedia of Knowledge Organization* (IEKO)

As already said, the author of the present article is also the editor-in-chief of IEKO, a source I hope can benefit both research and education in KO. Education in a field demands access to teaching aids like textbooks and other information resources. IEKO is an attempt to develop a free, peer-reviewed online resource backed by formal publication in the journal *Knowledge Organization*. The emphasis in IEKO is on theoretical and conceptual issues in KO, such as including theoretical issues, criticisms, and debates on specific systems such as the Colon Classification or the – > PRECIS system.<sup>[53]</sup>

As a resource under development, IEKO should not just be evaluated based on its present contents, but on its aim and possibilities. The articles in IEKO should not be considered endpoints or the last word about the concepts they are about; they should rather be considered subjects for further analysis representing an understanding of what the domain of KO is about (or should be about). That said, each article attempts to provide not only an authoritative status about the research on the subject, but also comprehensive bibliographic references and other kinds of resources for further studies. In addition to being available online and free, a major advantage is that it is updatable: new views can be added, e.g., in the form of quotes and bibliographical references. Whereas most sources only present a single definition of a concept (often conflicting with definitions in other sources), IEKO's priority is, as far as possible, to present alternative views and concepts, which hopefully will increase the interest in different conceptualizations of KO phenomena. IEKO should not be understood as a suggestion for a curriculum and its readings, but as a resource from which teachers may get relevant information to process for their specific contexts. The following kinds of articles should be mentioned in relation to educational purposes.

IEKO aims to cover:

##### (1) Universal KOSs

- *Traditional library-oriented KOSs* (e.g., DDC, LCC, LCSH, UDC, CC, BC2, PRECIS, including such systems from different countries, e.g., – > [etc.] *Chinese Library Classification*, *Korean Decimal Classification*, the Japanese *Nippon Decimal Classification* and the Russian *Library-Bibliographical Classification*).
- *Related systems used by other kinds of institutions* (e.g., *BISAC Subject Headings List* (devel-

oped by the book industry), *Canadian Research and Development Classification* (used and developed by research management authorities), and *Nomenclature for Museum Cataloging*).

- A third group can be called *experimental systems* (developed by researchers in KO), such as *Basic Concepts Classification*, the *Integrative Levels Classification* and the *Information Coding Classification*.

The ideal is that for each system the more technical information about its structure and principles, a comprehensive bibliography of writings about the system, information about its use and reception, and discussion of theoretical issues are given. The theoretical discussion should not just describe the system's own self-understanding, but also discuss the system considering more general theories, including present-day perspective and broader philosophical perspectives. These are the aims, even if their consequent fulfillment of course is somewhat utopian, and depends on the interest of researchers in contributing. An idea is also to provide a basis for considering related issues as well as differences to develop a general picture of KO as a field (e.g., considering the challenge from systems such as BISAC for the systems traditionally developed by the library sector, thereby questioning a narrow LIS conception). For systems no longer in use (e.g., PRECIS, as mentioned), their relevance therefore is also to illuminate why they are no longer used.

- (2) *Domain-specific KOSs*, where IEKO's goal is to cover the most important systems in all broader fields of knowledge, as well as some in narrower fields. *Astronomy's Three Kingdom System*, *Diagnostic and Statistical Manual of Mental Disorders*, *Hornbostel-Sachs Classification of Musical Instruments*, *International Classification of Diseases*, *Physics Subject Headings* and *RILM Index* (Répertoire international de littérature musicale) are already published articles, but of course the plan is to publish article also about important systems such as the *Periodic Table* of physics and chemistry, the *Linnaean taxonomy*, etc.

The purpose of such domain-specific systems is the increase in cooperation between subject specialists and LIS professionals, and such systems are both considered important for enriching the LIS field with theoretical concepts and theory, and for providing a concrete input on how to classify specific fields (e.g., for updating general classifications).

- (3) *Knowledge organization in a particular domain*, such as Archaeology and knowledge organization, Art studies and knowledge organization and classification of psychology.

In contrast to the former set, these are not about a particular KOS, but about domain-specific principles (and presenting different KOSs in the domain). A general theme is that any KOS always reflects a certain “paradigm” in the field it organizes, that is a KOS always reflects a certain conceptualization of the field, and therefore cannot be neutral (although this view unfortunately is not present in all articles).

- (4) *Different kinds of KOS* such as thesauri, classification systems, ontologies, hypertext, tagging systems (folksonomies), and keywords.

It is essential to teach the similarities (they are all systems of concepts and their semantic relations) as well as their differences (e.g., the different number and kinds of semantic relations they display). Again, this is not a simple task, as there are many conflicting views and definitions.

- (5) A fifth category, *methods, approaches & philosophies* includes Boolean logic; Citation analysis; Domain analysis; Facet analysis; Genealogical classification, Logical division and Science mapping.

This category is probably the most important from an educational perspective because it is about what LIS professionals should be able to do concerning KO, namely the methodological basis of the field. It seems important to compare the different approaches in an in-depth way, because this is about strengthening the foundation of KO by research.

There are more categories, but these five are sufficient to exemplify the possible role of IEKO for education in the field of KO. If there is one thing that should be emphasized, it is the need for conceptual clarity. This may sound as a trivial demand, but the reality is that most people in information science are not able to provide an argument about the meaning of *information*; in knowledge organization, the same is often the case with terms such as *classification*, *taxonomy*, *ontology*, *subject*, etc. etc. Often such confusion is caused by the lack of hard work by researchers, failing to consider the different meanings suggested by the literature. Worse, it may be caused by unscholarly introduction of buzz-words intended to “sell” rather than to establish clarity,<sup>[54]</sup> i.e., to make hype. It is always important to try to distinguish hype from sound research (e.g., as Devedžić 2020 does in relation to artificial intelligence, AI). We in KO

study concepts and their semantic relations. We need to bring order in our own concepts and their semantic relations. Without such clarity, people in the field are confused, and real progress and solid knowledge cannot be obtained.

## 5. Conclusion

Much of the practical relevance of KO is related to the process once known as literature searching or document searching, today often called information retrieval (IR), information searching, or information seeking (which, however, should not be considered synonyms).<sup>[55]</sup> As already mentioned, it is important for education in KO to maintain this perspective, although Internet search engines seem to have challenged this education, and even the possibilities for optimizing search based on the principles of strategies for maximization of recall and strategies for maximization of precision.

KO needs to defend itself against dominating assumptions in IR, which tend to see KO approaches as irrelevant; if we cannot do so, we do not deserve to continue as an academic field. In Hjørland (2021), I found that the most important difference between the dominant assumptions in IR and KO relates to the aim, implicit in KO, at providing authoritative scholarly knowledge. By contrast IR is based on techniques such as exact match, best match, popularity measures and personalization, which, at best, are only indirectly connected to the truth, relevance and cognitive authority of the documents retrieved. From an educational perspective for KO, such attempts to justify its existence are also important.

I will provide some suggestions of what, according to my view, might be taught in KO.

At an elementary level, courses may include:

- The universe of bibliographic data (perhaps best taught in connection with reference managers such as Zotero)
- A brief introduction to developments in library classification, as well as archive and museum KO principles, subject bibliographic databases (with citation indexes), and Internet search engines.
- Kinds of knowledge organization systems
- Subject analysis (emphasis on the difference between the “document-oriented view” and the “request/policy-oriented view”.
- Search strategies in classical databases (strategies on optimizing recall and precision, and the role of different subject access points).
- Comparison of classical databases and Internet search engines for professional search purposes (it seems important to distinguish professional search purposes from nonprofessional purposes)
- Introduction to an ontology management tool

- Introduction to the semantic Web, linked data and associated standards such as – > SKOS.

Possible issues to be taught at an advanced level may include:<sup>[56]</sup>

- Aspects of the theory of knowledge and the theory of – > science (as a basis for the following points)
- Concept theory
- Semantic and lexical relations
- Terminology and controlled vocabularies
- Classification methods and approaches (including logical, statistical, genealogical, and pragmatic/critical approaches)
- Classification history (from Aristotle, via Linnaeus, over Darwin to contemporary theory such as Wittgenstein and Kuhn)
- Subject access points and subject theory
- KO in a concrete domain of knowledge (– > domain analysis)<sup>[57]</sup>

The most important conclusion is probably the argument for theoretical commitment. There is no knowledge free of theoretical assumptions, and different approaches to KO are often based on different philosophical assumptions. If this is not recognized, the theoretical problems cannot be solved, and knowledge cannot evolve. If we are not committed to a standpoint, we cannot systematically examine it. That does not imply orthodoxy, however. We should be open to revise our theoretical commitment, but that means we should be committed to a new standpoint.

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### Endnotes

1. Hudon (2021, 11) showed that the terms *organization of information* (OI) and *information organization* (IO) are now by far the most used terms for knowledge organization in master's programs accredited by the American Library Association, seemingly being used as synonyms, with OI being the most applied phrase.
2. Stock and Stock (2013), for example, use "knowledge representation" for what is here termed "knowledge organization". It should be said, however, that *knowledge representation* has a large literature of its own which, contrary to KO, is mostly related to artificial intelligence.
3. Standard textbooks in IR include, for example, Baeza-Yates and Ribeiro-Neto 2011, Manning, Raghavan and Schütze 2008. Although such books may mention KO issues such as thesauri, this is too little to involve knowledge organization in teaching programs dominated by typical IR approaches. The term IR is, however, also used by researchers in knowledge organization, an example is the textbook in KO by Anderson and Pérez-Carballo 2005 with the title *Information Retrieval Design*.
4. Specific communities and fields related to the KO community include the bibliometric community, the Document Academy, Dublin Core community, IR, information resources management, knowledge management, ontology communities (such as the Open Biological and Biomedical Ontology Foundry), philosophy of classification, science studies, subject-specific communities, e.g., biological systematics, terminology studies, the World Wide Web Consortium (W3C) etc. Among these, the philosophy of classification is less a cohesive community than a set of scattered contributors, but nonetheless very important for KO. Philosophical contributions include works on specific domains such as biological classification, the Periodical system and the Diagnostic and Statistical Manual of Mental Disorders, as well as studies of contributors to classification theory from Plato and Aristotle over Linnaeus to Peirce, Wittgenstein, and Kuhn. It also includes studies of single concepts and issues, such as natural versus artificial classification (with the concept "natural kind"), concept theory, essentialism, issues of objectivity and subjectivity of classification, the issues of "taxonomic monism" versus "taxonomic pluralism," etc.
5. The concept of "theory-laden" is known from Hanson (1958) and Kuhn (1962), who focused on the theory-laden nature of observations, which has revolutionized our understanding of science. The implication of this concept is that our criteria for what qualifies as evidence are theory-laden. Because the actions we perform are influenced by our knowledge and views, practices are theory-laden as well as observations. This is the reason theory has profound importance for all deeper analysis and thereby for all higher education.
6. Lancaster (2003, 35-37) briefly discusses theories of indexing and wrote (36): "In fact, I have not been able to find any real theories applicable to the process of indexing". This is strange, since Lancaster himself (ibid. 9-13) advocated the "request-oriented" view of indexing, which, if anything is a theory (contrary to the theory of "content-oriented indexing", this last one represented by the Library of Congress' 20% rule). See further about theories of indexing in Hjørland (2018, Section 3, 612-22).

7. The homepage for the American Library Association (ALA) wrote (2022-05-10):  
 “What should I major in as an undergraduate if I want to go on to get an MLIS degree?”  
 A: Your undergraduate major can be in anything you choose, as long as it is from an accredited institution. An undergraduate degree in library science is not necessary. If you think you would like to work in a particular type of library, a degree in a related field may be useful. For example, a bachelor’s degree in a science or health-care field combined with an MLIS might make you a good candidate for a position as a medical librarian. If you want to be a librarian in a university music library, an undergraduate degree in music would be helpful.” [https://www.ala.org/educationcareers/accreditedprograms/faq#appropriate\\_degree\\_for\\_librarian](https://www.ala.org/educationcareers/accreditedprograms/faq#appropriate_degree_for_librarian)  
 Even Gorman’s (2002, 11-12) “ideal library school” describes only a two-years curriculum, where the first year consists of mandatory courses for all students, “a form of General Education curriculum for librarians”, while the courses of the second year would consist of elective topics, build on the first year’s teaching, aiming at specializing in a particular branch of librarianship or type of library.  
 Gorman (2002, 12) described the curriculum in this way: “The first year cataloguing curriculum would cover all aspects of bibliographic principles and standards and their application in libraries and library services. The topics would include descriptive cataloguing (both access points and bibliographic description), subject headings, classification, filing rules, authority control, indexing and abstracting principles and practice, the organization and management of the cataloguing process, and cooperative cataloguing structures. Given that thorough knowledge, the students would then be equipped to take on the elective courses of the second year. The “cataloguing thread” would include classification theory, history of cataloguing, advanced descriptive and subject cataloguing (separate courses), indexing theory, design of online catalogues, bibliographic control of electronic resources, and archival cataloguing”.
8. ALA has at its homepage a “Directory of ALA-Accredited and Candidate Programs in Library and Information Studies,” which can be used to study curricula in the field: <https://www.ala.org/educationcareers/accreditedprograms/directory>
9. This ideal may, however, be challenged by some issues, including: (1) that it may not be a requirement to have a BA in order to study at the MA program – and neither a BA nor a MA to study at the PhD program, (2) that forms of teaching may be highly influenced by students’ own choice of fields in which to write theses for the programs, thus minimizing the part of course-content that can be presumed.
10. In Danish universities, courses in the philosophy of science in the discipline are mandatory, and in reality, a continuation of the required course in philosophy (called “examen philosophicum”) in all educational programs going back to 1675. Therefore, such a course is given in addition to courses in KO and is, from my point of view, an important background for KO, although perhaps rarely fully utilized.
11. Szostak wrote at the system’s homepage: “NOTE: We have in 2021 changed our F schedule [covering flora and faune] to reflect advances in cladistics: the classification of species based on genetic similarity. This replaced an Old F Classification that employed longstanding terminology such as Kingdoms, Orders, and Families.” <https://sites.google.com/a/ualberta.ca/rick-szostak/Basic-Concepts-Classification/the-classification-of-things-phenomena/f-flora-and-fauna/classifying-flora-and-fauna>
12. To exemplify the problems of classification in biology, two quotes from philosopher Ghiselin (1997) are illuminating. He wrote (p. 276): “[T]he [classification] procedure is anything but rigorous. The entities in question are more or less general in so many diverse, incommensurable, and often purely subjective ways that ranking them in that manner had little if any scientific value. This in addition to the point that the properties in question are largely a matter of tradition, artifacts of extinction, and how much information we happen to possess about one group or another.”  
 And (ibid., 180) he also suggested: “When one identifies a specimen, one decides which group it belongs to. In this process, its ‘distinguishing marks’ or ‘characters’ play an important role. For purposes of identification one wants characters that are conspicuous (“salient”) and easily made out. Identification manuals naturally emphasize such characters, as do the ‘keys’ by means of which organisms may be gradually narrowed down to the appropriate species or other taxon. Even if one does not get the impression from such an exercise that the characters so used are defining of the taxa, one still is apt to get the impression that classification is ‘based upon’ such characters. This is true even though the features that are given as diagnostics of taxa are not necessarily the same ones that are used in the keys.  
 If people who teach systematics and write the text books are confused about such fundamental matters, one might wonder about everybody else”.
13. Greer, Grover and Fowler (2013, 13-17) presented eight kinds of information professionals: Librarians,

Archive managers or archivists, Information managers/records managers, Information scientists/theorists, Information systems specialists, Information entrepreneurs, Web developers (webmasters) and Chief information officers (CIOs). Museum specialists are not included, but there is a tendency to provide educational programs for libraries, archives, and museums (LAM), cf. Hvenegaard Rasmussen and Hjørland (2021).

14. An anonymous reviewer wrote: "But this is a narrow and particular view of both the field and of "practical and professional" KO education. Equally, the examples given of particular KOSs, standards, and methods is narrow and particular, focusing very much on "traditional" information professions. But one might argue alternatively that the principles of KO are vital to understand for anyone creating or using any kind of dataset: schema and standards designers, data creators and wranglers, data scientists, or simply anyone trying to understand the connection between 'data' and 'AI'." This criticism is difficult to relate to because the principles of KO, which are vital to understand for anyone creating or using any kind of dataset, are not specified. In any case, my point is that no principle is "given" or immune to philosophical analysis. The neglect of such analysis is closer to the applied pole, while its presence is closer to the academic pole.
15. Szostak's example about books on freedom corresponds to a discussion by Wilson (1968, 92), who concluded: "For nothing definite can be expected of the things found at any given position [in a classification system]". Wilson has an interesting footnote in which he writes that authors of documents often use terms in ambiguous ways ("hostility" is used as an example). Even if the librarian could personally develop a very precise understanding of a concept, he would be unable to use it in his classification, because none of the documents use the term in the same precise way. Based on this argumentation is Wilson led to conclude: "If people write on what are for them ill-defined phenomena, a correct description of their subjects must reflect the ill-definedness". In Hjørland (1992), I suggested another conclusion: concerning the authors' use of ambiguous terms, the role of the subject analysis is to determine which documents would be fruitful for users to identify whether the documents use one or another term or whether a given term in a document is used in one or another meaning. Clear and relevant concepts and distinctions in classification systems and controlled vocabularies may be fruitful even if they are applied to documents with ambiguous terminology.
16. Morgan and Bawden (2006, 114) wrote: "The theory/practice issue is a complex one, and has been discussed by several commentators, including Sands [2002] and also Intner [2002], who notes that the issue has always dogged the teaching of cataloguing and classification; see Henderson [1987] for an earlier view of the same issue." Morgan and Bawden (2006, 113-4) further emphasized the difficulty of defining the practical elements in KO education, writing that "although it may be agreed that a combination of theory and practice is desirable, it is hard to define exactly what – in the context of formal education – constitutes practice". The concept of theory is, however, not less difficult, and this dimension is further developed in the present article.
17. There are different but related issues involved by avoiding raising theoretical questions in relation to KO: (1) for practitioners it is important to contribute concrete professional solutions. The questioning of the basis on which such concrete professional solutions are built, may seem a weakening of the professionalism; (2) if you have learned some specific methods, it is time-consuming to revise them; also, in academic work there is a saying "too much invested to quit", also known as the Concorde fallacy; (3) questioning certain methods and methodologies mostly involves conflicts with persons defending those methods. This is problematic if LIS personnel are considered semi-professionals supporting other professionals (e.g., medical doctors) and putting questions about the tools and procedures prescribed by the persons higher in the hierarchy.
18. Bloom's influential taxonomy of educational learning objectives (as revised by Anderson and Krathwohl 2001) describes a continuum of kinds of knowledge from concrete to abstract: factual, conceptual, procedural, and metacognitive knowledge. Factual knowledge includes concrete facts and terminology within a discipline, conceptual knowledge includes principles, theories, and generalizations, procedural knowledge includes specific skills, processes, and techniques, whereas metacognitive knowledge includes awareness of one's own learning, control and regulation of cognitive processes, self-knowledge, and contextual knowledge. However, the abstract-concrete distinction is philosophically difficult (see Cowling 2017, Chapter 2: "The Abstract-Concrete Distinction", 69-105). An important point in Hegelian philosophy is described by Blunden (2018): "Hegel says, in his essay "Who Thinks Abstractly?" that it is the uneducated person, not the educated person, who thinks abstractly – because the concepts they use have a more tenuous connection to reality, and are poorer in nuances, associations and theoretical grounding." The present article's distinction between theoretical and applied knowledge has another point of departure:

a concrete classification system is, for example, the DDC. Classifications or thesauri as kinds of knowledge organization systems (KOS) are more general and abstract terms, and KOS itself a yet higher level of abstraction. An important point is that the understanding of the concrete systems presupposes their similarities and differences from other systems, that is, the understanding of the concrete systems presupposes the understanding of the abstract systems, and vice versa.

The argument is not to downgrade the concept of practical knowledge, which is required in almost all education. If you study, for example, a foreign language at a university, you are supposed to learn to read and speak that language at a high level. This is different from, for example, doing research on the grammar or on the history of that language, although these two dimensions support each other. Rather the argument is that the theoretical justification for specific practical actions shall have a high priority.

19. Relevant standards in KO include, among many others, ANSI/NISO Z39.19-2005, standards for thesaurus construction, *BS 8723: Structured Vocabularies for Information Retrieval*, SKOS (Simple knowledge organization for the Web), etc.
20. Methodological knowledge includes methodology for facet analysis (Hjørland 2013), for – > science mapping (Petrovich 2020), for ontology construction and editing (e.g., the formerly mentioned Protégé), for domain analysis (Hjørland 2017b), etc.
21. ALA's Committee on Education (2021) is a draft version of a paper on core competences of librarianship. As such, it is written at a very general level. Section 5 is about "Organization of Recorded Knowledge and Information", which states (p. 6-7): "Rationale: All library professionals should have an understanding of principles, methods, tools, and goals of organizing and representing information and knowledge across cultures and identities. Library professionals should have essential skills to adapt to technological changes, revise descriptive/classification standards, solve problems, and make ethical decisions with recorded knowledge and information. Library professionals, regardless of their specific title and/or role, should have the foundational skills and understanding to:
  - 5A. Understand the principles, systems, trends, and goals involved in the organization and representation of recorded knowledge and information.
  - 5B. Implement the developmental, descriptive, analytical, and evaluative skills needed to organize recorded knowledge and information.
  - 5C. Maintain the systems of cataloging, collection, metadata, indexing, and classification standards and structures, and implement methods used to

apply, create, and discover recorded knowledge and information, and the weaknesses and strengths of these systems.

- 5D. Recognize the ways that cultural biases impact and influence the collection and description of recorded knowledge and information".

What are the challenges using such a policy statement for designing curricula in KO? One issue is what is meant by the principles, systems, and standards? It sounds as if these consist of a well-known, non-controversial set of principles, systems, and standards, which is not the case. Is the DDC system one of these systems? (or is the recommendation about the standards for the semantic web?) Most likely, the first is the case (see Hudon 2011). In that case, what should professionals be taught about the DDC? Although "the weaknesses and strengths of these systems" is mentioned by the committee, such knowledge is complex and seldom analyzed adequately in textbooks. Students are, for example, probably not taught that the DDC in many cases does not follow the requirements of logical division according to which any item to be classified inherits attributes from all its broader classes (as is the case in ontologies, for example). Kovacs (1989, 378) wrote: "Often students comment that they did not understand that there really is logic behind the way classification numbers are determined and shelf arrangement is designed". Perhaps for good reasons? Broughton (2015, 199): "DDC is quite exceptionally well supported institutionally, and this is undoubtedly one of the reasons for its tremendous success." This may be read that its success is not based on its basis in logic and research, but that institutions (Online Computer Library Center, OCLC and Library of Congress) maintain it and regularly publish updated editions, which however may not be updated to reflect contemporary knowledge and students may be concealed that DDC in many cases is based on obsolete knowledge (cf., Blake 2011, 469-470). It is also important to emphasize that DDC (and all the traditional library classification systems) were designed for two different tasks: (1) providing shelf organization of books in physical libraries, (2) serving as a tool for information searching in library catalogs. The first of these tasks makes severe limitations on systems for use as KOS in electronic databases, which is why the DDC is not a good choice for this purpose. [cf. Austin, 1979]

Point 5D above seems extremely important and relevant but not much information is available on this at an adequate level (which does not, of course, make it less important).

ALA's (2017) *Core Competencies for Cataloging and Metadata Professional Librarians* is a short document (10 pages) which seems narrowly focused on existing

- systems and processes, and lacks more theoretical issues related to, for example, classification and subject analysis.
22. Chu et al. (2022) just shortly mention “information organisation” in a section named “Information Resources Management” (which is commonly considered a different field with its own journals, organization etc.).
  23. Jeng (1993, 116; italics in original) preferred the term *organization of information* rather than *knowledge organization*. She wrote: “Advocates of the nontraditional curriculum have few suggestions to offer as to what constitutes *organization of information*. However, it is generally understood that by this term it is meant “the study of information outside the context of libraries [Bonzi 1984]”. (Compare the definition of knowledge organization I provided in Hjørland (2016b), which, among others, includes the context of libraries. It has traditionally been the library sector that has hired persons educated in KO, but also public and private corporations, and special concepts such as “corporate thesaurus” and “inhouse taxonomy” for such contexts have been developed. Texts focusing on the making of corporate thesauri (such as Lykke Nielsen and Eslau 2002) or Web design (such as Morville and Rosenfeld 2006) exemplify an explicit focus on KO for corporations.
  24. Jeng (1993, 114; italics in original) wrote: “This means that the students are exposed not only to the historical context of cataloging knowledge but also to the current practice of library cataloging using tools such as *Anglo-American Cataloging Rules*, 2d ed. (AACR2), *Library of Congress Machine-Readable Cataloging (LC MARC)*, *Library of Congress Subject Headings*, *Dewey Decimal Classification*, and *Library of Congress Classification*”.
  25. We may add to Jeng’s comment on the use of different kinds of guidelines for bibliographical records, that the LIS profession and education always have focused on the library sector rather than the sector of subject databases, which tend to provide higher priority to subject access and lesser to formalities, using standards, such as the Common Communication Format (Simmons and Hopkinson 1992).
  26. Jeng did, however, suggest a model of the “context of information in description and summarization” on which to base the curriculum, which introduced important concepts in need of further study.
  27. Jeng (1993, 122) wrote: “The two main processes in cataloging, i.e., descriptive cataloging and subject cataloging, represent two steps of the process that librarians have chosen to organize their materials: description and summarization for both the container and the intellectual content of an object. Description is done to ensure a means for physical access to an information object, while summarization is done to provide a surrogate of intellectual content of the object”. However, “description” is an unclear term for providing some kinds of metadata (e.g., disambiguation author names) and the processes of subject analysis and attribution of subject terms to documents are not just “summarization” (cf. Hjørland 2017c).
  28. Hudon (2011, 346) wrote: “The DDC exhibits all of the features that make a bibliographic classification scheme functional and that we want students to be familiar with; this would explain why DDC is taught in most classification courses offered in North American LIS schools as typical example of a hierarchical classification scheme. Most of our respondents are giving some time to the DDC in their courses; DDC is covered in 42 courses in our list of 51. We asked these respondents whether they are using the DDC schedules for teaching, and if so, what edition/version of the scheme is favoured. Not surprisingly, we confirmed that the DDC schedules are used as teaching tool in a large majority of courses (39 out of 42)”.
  29. Until about 2000, for example, most research libraries in Denmark classified their own books, but today they rely on free text searching and the classification and indexing made by the Library of Congress. Besides, it is a tragical truth that new systems developed on research have difficulty in being applied and upgraded. Only systems based on solid institutional support survive, and they are often terribly obsolete.
  30. About the semantic staircase see Hjørland (2021, 8-14) available at: <https://www.isko.org/cyclo/ir#4>
  31. In ISKO-UK there has been a debate: “The Great Debate: The Traditional Thesaurus vs Modern IR” (ISKO-UK 2015). The people who challenged the thesaurus never published their arguments, and the debate concluded with a voting strongly supporting thesauri. I feel that this way of making scientific decisions is problematic. Arguments should be published in the literature, and the strength of the arguments rather than by voting.
  32. Broughton (2010, 350) wrote under the label “The enduring value of knowledge organization theory”: “The success of ISKO UK also belies the commonly held belief that there is no interest in subject access, organization or retrieval in an age when so much data handling can be carried out automatically, and that expertise in the organization of information does not matter very much anymore. This is very apparent in the library and information science field, and the disappearance of traditional classification and subject cataloguing from library school curricula, together with cognate skills such as indexing, abstracting and subject analysis, is well docu-

mented, as are the resulting concerns of the profession. The downward trend in the place of classification in the curriculum was noted as long ago as 1965 (Mills, 1965), and during the last five years a number of papers have identified and lamented the lack of proper professional education in these skills. Davis (2008), in a survey of 47 American library schools, found that, although most provided a general option in cataloguing, only ten offered any education in subject analysis, that is the identification of subject content, and application of classification schemes and subject headings. Bowman (2006) describes a very similar situation in British library schools, where “cataloguing and classification have become largely invisible in professional education” (Bowman, 2006, p. 309), and where the discipline is disguised under a variety of other, more acceptable names. In addition, the treatment may be very superficial with little practical content.” (Related criticisms were raised by Elrod (2008), Gorman (2002) and others).

33. Gorman was a major critic of information scientists in relation to education in KOs, he wrote (2002, 3): “Powerless or indifferent library administrators combine, unwittingly or wittingly, with the second group of enemies of cataloguing. That group consists of the “information scientists” increasingly infesting many of the successors to library schools. Knowing nothing of libraries, library history, or bibliographic control, they press for cataloguing to be succeeded by courses that suit their non-library objectives and research interests and, thus, deprive their hapless students of skills that could make them employable in libraries”.
34. One of the anonymous reviewers objected at this point: “KO is described as integrally related to retrieval, and “it therefore is important that people organizing knowledge in detail understand searching techniques and the relative roles of different subject points in searching” (with an unacknowledged self-citation). Again, this is a specific perspective on KO: its uses and its manifestations (e.g., in search-focused structures such as thesauri). In contrast, one of the most widely taught texts in information organization is, I’d contend, Bowker and Star’s [1999] *Sorting Things Out*; Bowker and Star might say that KO provides the conceptual infrastructure for all datasets, and, accordingly, coordinates a vast array of activities—search being only one example. (Should the author object that Bowker and Star are sociologists and not KO scholars, well, this might be true for someone immersed in a certain conception of “KO,” but such an objection would be meaningless for many other scholars—including many KO instructors.) To be clear, my goal once again is merely to point out that this article is putting forth a particular viewpoint—not to demand that the author

change their viewpoint, but to request that the author be transparent about it.”

My comment is that I have also used Bowker and Star (1999) in my teaching, and I too consider it an important work, because it helped shifting attention from more formal properties of classification to bringing their consequences into focus (in my terminology a pragmatic turn in KO). I do not consider it a problem that the authors are sociologists, as KO should be an interdisciplinary field, bringing voices from many fields together. Still, I think that many educators have lost the perspective of LIS as a profession, and thereby the more systematic, goal-oriented focus of KO education and that one way to keep the focus is to consider the possible role of KO in relation to the challenge from search engines (as I have tried to do in Hjørland 2021).

Another researcher had a view related to that of the reviewer: Andersen (2015, 17) wrote: “retrieval is not the only purpose of classifying or organizing items in a given collection, as sometimes stated in the knowledge organization research literature. Social action is the purpose and retrieval is one out of many means of carrying out a social action”.

Again, whereas I find that the goal to support searching is clear and provides clear criteria for design and evaluation, I find the purpose “social action” rather vague. Whereas the literature of KO and information searching is explicit on how knowledge organization can serve searching (by using search strategies for increasing recall, respectively precision), there seems to be no concrete suggestions on how KO may support other forms of social action.

35. Bawden (2013, electronic source, no page) wrote: “at that time [about 1995] there were a number of search engines beside AltaVista: Lycos, Excite, Yahoo, Infoseek, Hotbot and more. They all had different searching functions, and were better for different types of material. People like me ran courses on how to get the best out of them. There was even a book, *Search Engines for the World Wide Web*, written by Alfred and Emily Glossbrenner in 1998 [3rd ed., 2001], which covered them all, and advised that we had to learn the strengths and weaknesses of each one, after first mastering the idiosyncrasies of them all ... And then Google came along and changed everything. Not because it was necessarily a better system.”

It seems, unfortunately, as if such teaching of information searching has weakened in schools of LIS (remark that Bawden wrote in the past tense). The unfortunate truth is perhaps, as I have suggested (Hjørland 2015b, 1570): “If alternatives to Boolean searches [such as Google] mean that we are not able to improve the precision of searches in either practice or theory (be-

cause we have no clear understanding of the underlying mechanisms and their mutual interactions), we are in a deeply problematic situation. It is not just precision devices which are not what they used to be; neither is retrieval theory. This is a major problem because theoretical knowledge should guide the development of new systems, their use, and education within LIS.”

36. The Royal School of Library and Information Science in Denmark used to have optional courses in “special bibliography” (including KO) in science, technology, social sciences, arts and humanities. Also internationally, such subjects were commonly taught and researched. Their almost total disappearance from the field is both strange and problematic.
37. The issue about the general learning from studying specific KOSs relates to a fundamental issue in KO: what is the common theoretical basis of KOSs? The focusing on which shifts the perspective from practical to theoretical education.
38. Blake (2011, 469-470) wrote “At present, many, perhaps most, current bibliographic classifications for mammals reflect quite outdated science. The latest edition of DDC, for example, arranges mammals in essentially the same way as the second edition of 1885”.
39. Broughton et al. (2005) considered KO in the narrow meaning as the direct object of KO, and the broader meaning, in which knowledge is organized in, for example, scientific theories and disciplines. The broader perspective is important because KO is mostly a secondary classification, which is dependent on how things are organized outside KO. However, the authors also warned about forgetting the LIS focus (143): “Although the broad perspective is important, there is a danger that the teaching of broader perspectives of KO and KOS do not provide specific insight on how to construe, evaluate and use KOS. Any concern with broader perspectives should be justified by demonstrating consequences for KO in the narrow sense”.
40. A colleague of the author has taught “UML” as part of the MA course in knowledge organization, using Seidl et al. 2014 as textbook. This choice was based on arguing that this language is used by many companies, why it is relevant for the students’ employment possibilities. (This language was chosen because the ontology-editor Protégé [https://en.wikipedia.org/wiki/Prot%C3%A9g%C3%A9\\_\(software\)](https://en.wikipedia.org/wiki/Prot%C3%A9g%C3%A9_(software)) turned out to be too complicated for this teaching program).
41. Relevant educational materials on thesaurus-construction include Aitchison, Gilchrist and Bawden 2000, Broughton 2006, Dextre Clarke 2019, ISO 25964-1: 2011 and ISO 25964-2: 2013.
42. Rather than considering that X is synonym with Y, students should learn to consider when X has been considered synonymous with Y, and whether, for a given purpose (e.g., a given thesaurus) X and Y should be considered synonyms (i.e., when it is fruitful to consider X and Y as synonyms), that synonymity is not something hardwired in the human mind or given a priori, but it is a human choice. The same goes for all other semantic relations: they are contextual, and domain- and theory-dependent. The view about semantic relations expressed here contrasts with the widespread misunderstanding that relations in thesauri and other knowledge organization systems are “Context-Free, Definitional, and True in All Possible Worlds”, see further in Hjørland (2015a).
43. Another question is about classification into such well-established categories as cities versus states, animals versus plants, fish versus mammals etc. In such cases commonsense works better, but that is not to say that it is without theoretical problems. Hermida (2022), for example, claims “Cats are not necessarily animals.” (I have not considered if I consider this claim sound or not, but it is a part of the contemporary philosophical discussion). Concerning the concept “fish” see Helfman *et al.* (2009, 3). The points here are: (1) be careful to take commonsense categories for granted because all the categories (e.g., of life) that we use are created and defined by humans for various purposes and are based on different kinds of knowledge. The categories tend to change as we learn more about the things that are categorized and their mutual relations; (2) Consider that any set of elements can always be classified in many ways, why the most relevant criteria for a given purpose should be considered.
44. Pluto was considered a planet until 2006 but was then downgraded to “dwarf planet” by the International Astronomical Union (IAU). Dick (2013, 29) wrote: “Despite definitions and analogs, it was not clear whether Pluto should be a type of planet or a new class entirely. The IAU opted for the latter, but in a confusing way by declaring Pluto to be in the new class of “dwarf planets,” but then declaring that a dwarf planet was not a planet at all!”  
Other examples of discussing semantic relations considered facts are: is water H<sub>2</sub>O? (Chang 2012) and are cats necessarily animals? (Hermida 2022).
45. Criteria for distinguishing between good and bad systems and processes should not, of course, be based on the view that there is one right solution but should recognize the theory-laden and interest-based nature of such criteria.
46. Recently a peer-reviewer wrote about an article about a KOS: “But more substantially, the point of the article is unclear. Is this a simple review of the [name changed to X] system, the kind of thing that reads like a lengthy

Wikipedia entry? Or is there an academic question, hypothesis, or theory embedded in the manuscript somewhere? If there was some sort of a more substantial analytical angle to the paper – which is generally expected of an academic publication – it was unclear.”

47. This overestimation of the information specialists at the expense of other professionals was especially clear in Beghtol (2003, 64), who wrote: “In this paper, classifications for information retrieval are called ‘professional’ classifications because they are devised by people who have a professional interest in classification, and classifications for knowledge discovery are called ‘naïve’ classifications because they are devised by people who have no particular interest in studying classification as an end in itself” (further debated by Hjørland and Nicolaisen 2004, answered by Beghtol 2004) with a rejoinder by Nicolaisen and Hjørland. (2004). Mostly, however, the overestimation of information specialists in classification research is seen by their neglect of relevant literature by other professional groups. Philosophers and classification researchers in many fields do have a professional interest in classification that often makes them more, rather than less “professional”.
48. Ontological and metaphysical theories are not presented in this paper, but it should be said that the epistemological views are not independent of ontological and metaphysical views.
49. Kovacs (1989, 377) wrote: “Students should be aware of how these thesauri are created, how they are structured, and how they can be used most effectively. They should be aware of their options, should they become catalogers, of appropriate ways to meet the needs of their clientele. They should not, however, be told that there is only one way to describe an item’s subject. In my experience, I have never seen a library that does not make exceptions to the subject heading authority list it uses”.
- Yes, but on the other hand, not any indexing will do. We need to distinguish between good and bad indexing (otherwise, there is no reason for learning about it). The core concept in this respect is “request oriented” (or better “policy-oriented”) indexing, (see Hjørland 2017c, Section 2.4). Again, this demonstrates the necessity of theory for practical work.
50. If the computer is superior for authorship disambiguation in some experiments, these should of course be interpreted and followed up, and possible both humans and computers doing this task could learn from the research and improve their performance, why new studies need to be made. A comparative example is an experiment that found that computers are better than the average dermatologist in diagnosing skin cancer, but not as good as the best dermatologists (see Katsikopoulos et

al. 2020, 83-84). If valid, such knowledge should be used to improve the average performance of a dermatologist and not just to accept an average improvement – but still providing important roles for computer diagnosis.

51. An example of a historical study of education in KO relating this to developments in both theory and practice was done by Raghavan (2005) about India.
52. One issue is the availability of qualified applicants for professorships in KO (there have been cases where KO have not been able to fill a position as professor in KO, and therefore the position was filled by a professor from another subfield of information science).
53. CC is not much used anymore, even in India, and PRECIS is no longer used in practice. Therefore, in my opinion, the most important to communicate about such systems are not their technical details, but what we may learn from the debate about their theoretical assumptions.
54. Dextre Clarke (2008, 433) considered *taxonomy* a buzzword used synonymous with controlled vocabulary from about 1994: “But the progressive roll-out of corporate intranets [the term intranet originated 1994] soon posed a cruel question: what was the point of having all those resources ostensibly at your fingertips if you could not find them? The software vendors were quick to spot the opportunity. They would provide a search/navigation facility, and what better name for it than ‘taxonomy’? Software products have proliferated, and so too have websites with all manner of ways of selecting from a top list of subject areas and ‘drilling down’ to progressive levels of specificity. As the taxonomy buzz-word spread around, many information professionals seized a different opportunity. They rescued their existing home-grown thesauri, subject heading schemes and classification schemes, dusted them off a little, and re-branded them ‘taxonomy’. The controlled vocabulary has now become more popular than ever before! The website at [www.taxonomywarehouse.com/](http://www.taxonomywarehouse.com/) gives some idea of the wide range of vocabularies currently available.” (The cited website is no longer available but is replaced by [www.synaptica.com](http://www.synaptica.com). The version cited by Dextre Clarke can be found in the Internet Archive at <https://web.archive.org/web/20090122022437/www.taxonomywarehouse.com/>)
55. Although the term *information retrieval* is used in different meanings, the literature of IR is today dominated by computer science, and as a research field has largely migrated from information science to computer science, with a somewhat different emphasis. The term *information seeking* is mostly used about descriptive studies on how people seek information, less about nor-

mative principles on optimizing search strategies, and without interest in the issues studied by KO, such as the role of KOS in information seeking. Therefore, *document searching* (or *information searching*) seems the best term from a KO perspective.

56. The elements here suggested for the advanced level present a dilemma, because they are foundational, and in a way should be taught before the elements suggested at the elementary level. However, their motivation and contents should be intimately linked to and relate to the elements suggested for the elementary level, and thus presuppose intimate knowledge of this.
57. From a theoretical point of view, I have had success in using (parts of) Richards (2016) on biological classification. Some students expressed that this book provides a good understanding of the philosophy of classification beyond biology. From a professional point of view, medical knowledge organization is an important field that often welcomes information specialists. My original idea was to let students choose a domain of interest and work with problems of knowledge organization in that domain. The success of this last option depends on the timeframe of the course and works best in a specialized course or as the subject for an independent thesis (e.g., a master's thesis).

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