

Viewing information literacy concepts: a comparison of two branches of knowledge

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Abstract An integrative approach is taken to mapping the field of research on information literacy in health sciences and social sciences. The objective was to identify the conceptual structure of these areas, and to determine their main research fronts and descriptors, and the relationships between them. A further objective is to determine whether information literacy is a consistent area. The basis of the study is the use of the program VOSViewer to analyse the co-occurrence of the areas' descriptors, grouping them into clusters and generating a map of their connections. Information retrieval was by retrospective searches of the Web of Science (Thomson Reuters) and Scopus (Elsevier). The results for the health sciences area yielded four clusters. The centralmost descriptor was *Education* (with a total link strength of 1,470), which was strongly linked to the descriptor “*Information retrieval*”, and weakly linked to “*Information skills*”, “*Information seeking*”, and “*Information Science*”. In social sciences, there were six clusters. “*Information literacy*” was now the descriptor with most occurrences (812) as well as having the greatest weight—a total link strength of 2,340—followed by “*Education*” with 839 occurrences. The resulting maps provide a graphical identification of the main research issues and trends in information literacy in these two areas of expertise which, according to the data of the present study, correspond to lesser (health sciences) and greater (social sciences) scientific production. Information literacy was seen to be conceptually more consistent in health sciences than in social sciences. However, at least for the moment, it is

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a still growing conceptual space that is in need of solid indices of consistency and specificity.

Keywords Information literacy · Health sciences · Social sciences · Visualization of similarities

Introduction

Information literacy (IL) is a set of skills and competencies required in the knowledge and information society of the twenty-first century to retrieve, analyse, and use information. It consists not only of acquiring the ability to know when and why one needs the information, but also where to look, and how to use it once one has found it. That IL is an essential capacity for individuals in today's world is reflected in its being one of the five priority areas of the UNESCO's intergovernmental Information For All Programme (IFAP). The objective of this program is to help member states design and implement national information and communication policies. Participants in the high level colloquium on information literacy and lifelong learning held at the library of Alexandria from 6 to 9 November 2005 declared that: "*Information literacy and lifetime learning are the beacons of the Information Society that illuminate the paths to development, prosperity, and freedom.*"

The presence of IL as such a beacon is also reflected in the exponential growth of scientific production in these areas of knowledge. This production has a broad range of descriptors of the topics it covers, with a multiplicity of aetiologies and descriptors reflecting IL's role in the development of civil society and of democracy in particular (Ogris and Westphal 2006), in the generation of active citizenship (Spitzer et al. 1998), in improving personal competencies (OECD 2007), and in knowledge and organizational management (Davenport and Prusak 2000; Castells 2001; among others).

One of the objectives of the present study was to identify the main research trends in IL. To this end, we took as the domain for the study two scientific areas that are extreme in terms of their publication volumes—social sciences (SoS), the most productive, and health sciences (HeS), the least. In particular, we wanted to determine which are the emerging research issues in these two areas, how they are approached, which descriptors are the most commonly used and how representative they are, etc. Some particular research questions were: What is the structure that IL presents, what are its emerging research topics, what are its principal descriptors and how do they relate to each other, and how has it developed and been implemented in that period? The aim was to create a single graphical representation of the data of the web of interrelationships in each of these two fields, displaying the relative proximity of their respective concepts. We also wanted to examine how conceptually consistent is the field of IL. For this purpose, we studied and analysed the descriptors in the literature of these two branches of knowledge.

Literature review

The scientific production on IL has been gaining in importance in recent years. There has been some bibliometric research of a general character. Rader and Coons (1992) and Rader

(2000) study the evolution of this production centred on applications of IL in higher education and the role of libraries in the process of students' learning various informational competencies, considering a specific group of countries—USA, Canada, UK, Australia, and New Zealand. Virkus (2003) analyses the development of IL in Europe, providing an overview of the concepts most frequently used by European authors and of the diversity of contexts in which they are used. Lau (2007) studies the status of IL initiatives worldwide, with the aim of identifying the main working groups, associations, and organizations, as well as training programs and other events.

Other basic bibliometric studies include that of Pinto et al. (2010a, b) which focuses on the terminological, conceptual, and statistical analysis of the evolution of the descriptors that have been used in IL over the last 30 years, with an emphasis on their different meanings according to the perspectives and contexts involved. Dudziak (2010) examines the global scientific output to identify the main trends of research related to IL, also covering the previous 30 years. Pinto et al. (2011) analyse the interrelationships between two clusters extensively used in IL—information literacy, information skills, and library skills on the one hand, and computer literacy, Internet literacy, and digital literacy on the other—by studying the scientific production reflected in several specialized databases for the period 1997–2009. The results show a steady decrease of publications on traditional user training, represented by “*Library skills*” and “*Information skills*”, which are replaced by an increase in the concept of “*Information literacy*” which becomes predominant in the most recent years in contexts of information competency training. There was also a decline in relevance of the descriptor “*Computer literacy*”. This seemed to be because of the impact of the Internet, of the so-called Web 2.0, and of multimedia technologies. It was progressively replaced by the concepts “*Internet literacy*” and “*Digital literacy*”. One is thus led to believe that current research is more oriented towards studying the competencies needed to manage and use information and knowledge rather than technology.

A recent bibliometric study of scientific productivity in IL in the fields of health sciences (HeS) and social sciences (SoS) during the period from 1974 to 2011 (Pinto et al. 2013) showed an exponential growth, with coefficients of determination $R^2 = 0.9449$ in HeS and $R^2 = 0.7674$ in SoS. The growth rates in the last 5 years studied (2006–2011) were 12.2 and 11.3 %, respectively, with the number of both fields' articles doubling in that 5-year period.

With respect to the authorship of the works, there were a total of 963 authors in HeS and 4,071 in SoS. The collaboration indices were 1.87 and 2.62 respectively, with 69 and 53.6 % of the documents having two or more authors. In both fields, the productivity of the authors fitted a Lotka-type distribution, with means of 1.12 works/author in HeS and 1.29 works/author in SoS. The author affiliations were extensively spread worldwide. In SoS, there was a mean of 4 works/institution, with the most productive being the California State Universities (49 publications), Purdue (44), and Illinois (33), followed by the Universities of Sheffield (26), Granada (25), and Charles Sturt and Queensland Universities (23 each). In HeS, there was also a notable diversity of affiliations, with more than 300 institutions. The most outstanding countries and institutions were the U.S. (University of Wisconsin), Cuba (Infomed), and Australia (University of Sydney).

In SoS, 47 journals stood out as the most productive on information literacy, mostly North American, with 22 being included in the 2010 Journal Citation Reports (JCR). The top three were Reference Services Review (109 articles), Journal of Academic Librarianship (91), and College and Undergraduate Libraries (57). In HeS, the equivalent numbers were 24 journals standing out, with 14 being included in the 2010 JCR. The top three were

Health Information and Library Journal (32 articles), ACIMED (19), and Medical Reference Services Quarterly (13).

In HeS, Saranto and Hovenga (2004) review the literature on IL for health professionals based on the analysis of articles in the Medline database. They find that: “*The concept of IL has not yet been established. It is sometimes used interchangeably with computer literacy and informatics awareness or with the ambiguous descriptor computer experience.*” They also note that existing bibliometric studies have focused preferentially on the various concepts connected to “*Health literacy*” as in the works of Kondilis, Soteriades and Falagas (2006) (who analyse European scientific production in the PubMed database on the concepts “*Health literacy*”, “*Readability*”, “*Health competence*”, and “*Informed consent*”) and Bankson (2009). As indicated by Mancuso (2009), there is some confusion between the concepts of “*Health literacy*” and “*Health information literacy*”. Indeed, the first article to address both was that of Burnham and Peterson (2005). They took the definition of “*Health information literacy*” proposed by the MLA (2003) in which the concept is to be understood as the combination of literacies in both health and information. Thus, it appears that the descriptor “*Health information literacy*” has actually been in use since 2003, although its impact on overall health literacy has yet to be examined (Shapiro 2010).

A variety of topics have been addressed in these studies—theory, policy, procedures, applications, education, and evaluation. The approaches have been multidisciplinary from different fields of knowledge including information and documentation, education, administration, communication, medicine, nursing, biology, etc. The concept of IL has a clear interdisciplinary and transdisciplinary character, and there is extensive collaboration between the different agents involved in its teaching and learning (librarians, academics, pedagogues, computer science specialists, etc.). There has nevertheless as yet been no recent integrative and innovative bibliometric study specifically mapping the field of IL in descriptors of the concepts it involves and their interrelationships.

Methods

Methodologically, the study design consisted of two main phases: information search and retrieval in the Web of Science (WoS, Thomson Reuters) and Scopus (Elsevier) multidisciplinary bibliographic databases; and pre-process depuration, storage, organization, and processing of the information retrieved.

In the first phase of search for and retrieval of information, the time window was 1974–2011, inclusive, and the unit of analysis was any indexed publication on IL in the health sciences and social sciences fields. The descriptors selected for retrieval were: “*Information literacy*”, “*Information competence*”, and “*Information skills*”, searching also for their variants such as singular and plural endings, etc. The results were restricted to the areas of Medicine, Nursing, and Psychology in the field of health sciences, and to Information and Documentation, Education, Law, Economics, and Sociology in the field of social sciences. A particular effort was made for the searches in the two databases to be as similar as possible, taking into account the differences in their query languages, document structures, and sensitivities in response to the various journals’ editorial policies.

In the second phase, the two sets of search results (HeS and SoS) were pre-processed and organized using the RefWorks (ProQuest) bibliographic management software package. Duplicates from the overlap of the two databases (Escalona, Lagar and Pulgarín 2010) were removed using the software’s “*View Duplicates*” module. The data required for

analysis—the field of knowledge and the keywords or descriptors—were then exported to the Access module of the Microsoft Office 2007 software package for treatment using the Excel spreadsheet module of that same package. For each set of data, a square symmetric matrix of co-occurrences was constructed, with the cells containing the number of times a given pair of descriptors appear together in the articles analysed.

From these matrices, a co-occurrence map was then generated using the freely available VOSViewer computer program (Van Eck and Waltman 2007; Van Eck et al. 2010). This allows the similarities between the concepts of each field to be viewed and studied in a two-dimensional space, and for the concepts to be clustered on the basis of a weighted and parameterized variant of the modularity function of Newman and Girvan (2004). The result is a single map for each field, showing the web of linkages between the concepts represented by the descriptors, and their relative proximity.

Results and discussion

Health sciences (HeS)

Figure 1 is an overview of the literature on IL published in WoS and Scopus in the HeS field, based on the descriptors in the 367 documents analysed (journal articles). The map shows descriptors related to the central IL concept, and provides information on how they relate to each other. Greater sizes of the coloured discs indicate greater numbers of occurrences.

The centralmost descriptor (linked to the greatest number of other descriptors) is “Education”. There stands out its strong relationship with “Information retrieval”. Descriptors on the edge of the map indicate that they have little connection with other descriptors. Examples are: “Information Skills”, “Information Seeking”, and “Information Science”.

The descriptors were grouped into 4 clusters, each linked to a sub-field of IL. The cluster which a descriptor belongs to is indicated with a certain colour. Clusters located close to each other indicate a close relationship between those sub-fields, while clusters far from each other indicate only a weak relationship. As can be seen, the descriptors are arranged in a ring pattern, with a substantially empty central zone and all the descriptors distributed around it.

Cluster 1 (red) is located to the left of the map. Its thirty-two descriptors are: “Access to information”; “Clinical practice”; “Decision making”; “Health education”; “Health information”; “Health knowledge, attitudes, practice”; “Health literacy”; “Health service”; “Health survey”; “Information dissemination”; “Information literacy”; “Information processing”; “Information seeking”; “Information seeking behavior”; “Information services”; “Information skills”; “Information technology”; “Medical informatics”; “Medical information”; “Medical student”; “Needs assessment”; “Outcome assessment”; “Patient education”; “Qualitative research”; “Reading”; “Statistics”; “United states”; “Higher education”; “Pilot study”; “Interview”; “Motivation”; and “Focus groups”. The most frequent descriptor in this cluster is “Information literacy”, and the cluster as a whole could also be identified as corresponding to the theme of information literacy (health literacy, practices, core competencies, information competencies, IL research, higher education, and patient education). The importance of information competency training for health science professionals is twofold, since mastering the skill of finding and managing information gives access to current research and best practices,

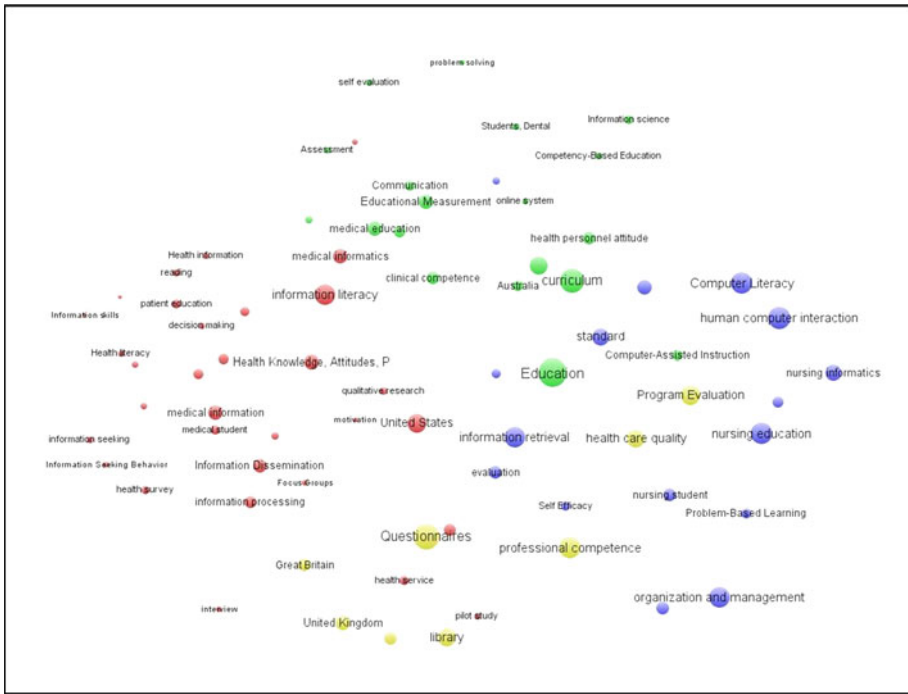


Fig. 1 Map of IL descriptor co-occurrences in HeS

contributing on the one hand to the delivery of quality services, and on the other to the exercise of a professional practice that is well documented, with adequate internalization of clinical history semantics (Schwarz and Wojtezak 2003).

Cluster 2 (green) is located at the top centre of the map. Its nineteen descriptors are: “Assessment”; “Australia”; “Clinical competence”; “Communication”; “Comparative study”; “Curriculum”; “Computer-assisted instruction”; “Competency-based education”; “Educational measurement”; “Health personnel attitude”; “Information science”; “Learning”; “Education”; “Medical education”; “Online system”; “Problem solving”; “Self evaluation”; “Students, dental”; “Teaching”. This cluster could be identified as corresponding to the following themes: Literacy Education/Instruction; Teaching; Learning IL; IL Assessment/Evaluation; Medical Education. The significant weight of its descriptors correlates with the transfer of IL knowledge and applications to education. This is evidenced by the publication of the first standards applicable to higher education (AASL 1998; ALA 2000) which formed the basis for similar actions in other countries such as the UK, Australia, etc. These standards address a range of competencies, from knowing how to recognize a need for information to the ability to locate, evaluate, organize, retrieve, disseminate, and use the information to generate new knowledge. In addition, there is the fact that many HeS professionals are also teachers, and they investigate and manage a huge amount of information. They therefore have to have acquired and continually reinforced their ability to identify, analyse, evaluate, retrieve, and organize the information they need to help them in solving problems and making decisions. These requirements concur with some of the recommendations made by the UNESCO on the need for HeS professionals to receive training in information competencies (Horton 2007). Two examples are

Recommendation nine oriented towards public health professionals (that all nations and in particular the health authorities and professional associations...should ensure the availability of continuing education in health IL for all professionals involved in its practice...), and Recommendation 11 oriented to managers and others in charge of health services (that they should ensure that both the core and the advanced curricula of healthcare professionals include the development of specific information literacy competencies). But also, as argued by Ivanitskaya, O'Boyle and Casey (2006): "*Health educators must continue to partner with a variety of groups that play an important role in promoting health information literacy, such as librarians and educators.*"

Cluster 3 (blue) is located on the right of the map. Its sixteen descriptors are: "*Computer literacy*"; "*Continuing education*"; "*Cooperative behavior*"; "*Evaluation*"; "*Evidence-based practice*"; "*Human computer interaction*"; "*Information management*"; "*Information retrieval*"; "*Librarian*"; "*Nursing education*"; "*Nursing informatics*"; "*Nursing student*"; "*Organization and management*"; "*Problem-based learning*"; "*Self efficacy*"; and "*Standards*". The most frequent descriptor in this cluster is "*Computer literacy*", probably reflecting the development of an interdisciplinary concept of IL that has led both to collaboration between librarians, academics, and computer scientists in the development and implementation of programs on IL (Cope and Kalantzis 2000; Kellner 2000) and to socialization of its principles, which are present in almost all facets of life, including the individual's ability to obtain, interpret, and understand basic healthcare services and information, the proper use of that information, and the right to be informed (Grant 2002; Ivanitskaya, O'Boyle and Casey 2006). Nevertheless, Saranto and Hovenga (2004) state that the use of the descriptor "*Health information literacy*" is recent, and has been generating some confusion with the concepts of informatics awareness and computer literacy, and with the ambiguous concept of computer experience. This cluster could be identified as corresponding to the following themes: Computer Literacy; IL Standards; Librarian.

Cluster 4 (yellow) is located at the bottom of the map. Its eight descriptors are: "*Professional competence*"; "*Questionnaires*"; "*Library*"; "*Program evaluation*"; "*Health care quality*"; "*United Kingdom*"; "*Great Britain*"; and "*Library services*". The most frequent descriptor and size is "*Questionnaires*". In the process of information literacy, evaluation is a central axis covering several different aspects (Gratch-Lindauer 2004): the evaluation of work sessions in IL, of the formative work of librarians and teachers in the process, of IL programs, of students' learning, etc. Also, the process can take place in different scenarios—the library, the classroom, on campus and beyond, as self-training (Lannuzzi 1999), or with a practical focus on the use of information (Markless and Streatfield 2007; Oakleaf and Kaske 2009; Head and Eisenberg 2010). But whichever the scenario, the same instruments are used to diagnose and measure IL competencies in training, higher education, and professional practice. One is the SAILS test (Salem and Radcliff 2006) which measures the information competencies of various groups of students. Another is the RRSA test "...based on the Information Literacy Competency Standards for Higher Education, and it measures proficiency of college-age health information consumers in obtaining health information, evaluating the quality of health information, and understanding plagiarism" (Ivanitskaya et al. 2006). This cluster could be identified as corresponding to the following themes: Professional Competencies; Library Services.

Figure 2 shows the co-occurrence density map for the HeS field. The descriptor "*Education*" (Cluster 2) is the most frequently occurring in the literature, followed by "*Questionnaires*" (Cluster 4), "*Curriculum*" (Cluster 2), and "*Computer literacy*" (Cluster 3). One sees that concepts such as "*Education*" and "*Information retrieval*" are closely related.

Table 1 Descriptors of health sciences with frequencies ≥ 5

Descriptor	No.	Type	Descriptor	No.	Type
Education	106	com	Health survey	15	sp
Information literacy	98	com	Medical student	15	sp
Curriculum	69	un	Library services	15	com
Questionnaires	67	com	Health education	15	sp
United States	58	com	Access to information	13	un
Nursing education	51	sp	Statistics	13	un
Professional competence	50	com	Communication	13	com
Human–computer interaction	50	un	Decision making	13	un
Computer literacy	49	com	Australia	12	com
Information retrieval	45	com	Health personnel attitude	12	sp
Organization and management	43	com	Clinical practice	12	sp
Library	42	un	Reading	12	com
Teaching	40	com	Cooperative behaviour	11	un
Librarian	39	com	Information science	11	un
Medical informatics	39	sp	Information technology	11	un
Medical information	38	sp	Computer-assisted instruction	10	un
Standard	32	com	Health information	10	sp
Program evaluation	31	com	Online system	9	un
Nursing informatics	29	sp	Continuing education	8	un
Evidence-based practice	29	com	Information management	8	com
Medical education	29	sp	Information-seeking	8	un
Health care quality	29	sp	Comparative study	8	un
Information dissemination	24	com	Outcome assessment	8	un
Health knowledge, attitudes, practice	23	sp	Competency-based education	7	un
Learning	23	com	Information skills	7	com
Information processing	23	com	Self-efficacy	7	com
United Kingdom	22	com	Qualitative research	7	un
Information services	22	un	Assessment	6	com
Patient education	21	sp	Information-seeking behaviour	6	com
Problem-based learning	19	com	Interview	6	un
Clinical competence	19	sp	Motivation	6	com
Educational measurement	19	un	Problem solving	6	un
Health literacy	17	sp	Students, dental	6	sp
Evaluation	16	com	Higher education	5	com
Great Britain	16	com	Pilot study	5	un
Health service	16	sp	Focus groups	5	com
Needs assessment	15	com	Self-evaluation	5	un
Nursing student	15	sp			

com Common generic-type descriptors present in both samples (HeS and SoS), *un* Unique generic-type descriptors only present in this sample (HeS), *sp* Specific HeS descriptors

Table 2 Descriptors with the greatest link strength (HeS)

Descriptor	Total link strength	No. of occurrences	Link strength per occurrence	Cluster no.	Type
Education	1,470	106	13.86	2	com
Questionnaires	1,190	67	17.76	4	com
Curriculum	1,066	69	15.44	2	un
Human–computer interaction	890	50	17.80	3	un
Professional competence	882	50	17.64	4	com
Computer literacy	840	49	17.14	3	com
Nursing education	830	51	16.27	3	sp
Information retrieval	810	45	18.00	3	com
Information literacy	804	98	8.20	1	com

com Common generic-type descriptors present in both samples (HeS and SoS), *un* Unique generic-type descriptors only present in this sample (HeS), *sp* Specific HeS descriptors

Social sciences (SoS)

Figure 3 is an overview of the literature on IL published in WoS and Scopus in the SoS field, based on the descriptors in the 2,177 documents analysed (journal articles). The map shows descriptors related to the central IL concept, and provides information on how they relate to each other. Again, greater sizes of the coloured discs indicate greater numbers of occurrences.

One notes that “*Information literacy*” is the descriptor with most occurrences (808), and is also that of greatest weight, with a total link strength of 2,340, followed by “*Education*”. Other descriptors that stand out are “*Teaching*”, “*Academic libraries*”, “*Information retrieval*”, “*Library instruction*”, “*Information storage and retrieval*”, and “*Learning*”. The centralmost descriptors, linked to the greatest number of other descriptors, are “*Teaching*”, “*Information literacy*”, “*Learning*”, and “*Education*”.

The descriptors were grouped into six clusters, each linked to a sub-field of IL, with 24, 22, 19, 6, 4, and 4 descriptors, respectively. Clusters located close to each other indicate a close relationship between those sub-fields, while clusters far from each other indicate only a weak relationship. The map presents a horizontally elongated structure in which some descriptors, namely “*Information Literacy*”, “*Teaching*”, “*Learning*”, “*Education*”, and “*Librarians*”, are strongly linked to each other.

Cluster 1 (red) is located to the right of the map. Its twenty-four descriptors are: “*Australia*”; “*Computer literacy*”; “*Education*”; “*Educational measurement*”; “*Evaluation*”; “*Focus groups*”; “*Great Britain*”; “*Information dissemination*”; “*Information processing*”; “*Information retrieval*”; “*Information storage and retrieval*”; “*Learning*”; “*Library services*”; “*Motivation*”; “*Needs assessment*”; “*Organization and management*”; “*Organizational case studies*”; “*Professional competence*”; “*Program evaluation*”; “*Questionnaire*”; “*Reading*”; “*Self efficacy*”; “*Standards*”; and “*United Kingdom*”. The most frequent descriptors are “*Education*” and “*Information retrieval*”. This cluster could be identified as corresponding to the following themes: Information- Literacy-Lifecycle; Library Services; Standards. In keeping with the significant technological, educational, and pedagogical changes that have taken place in recent decades, the data confirm the emergence in the literature of works on information education, information competency training, training integrated into students’ curriculum, and the application of new teaching methods

Table 3 Descriptors of SoS with frequencies ≥ 5

Descriptor	No.	Type	Descriptor	No.	Type
Information literacy	812	com	Evidence-based practice	15	com
Academic libraries	135	un	Great Britain	14	com
Students	128	un	Information processing	14	com
Education	127	com	Knowledge management	14	un
Library instruction	102	un	Self-efficacy	14	com
Teaching	101	com	Australia	13	com
Information retrieval	68	com	Digital literacy	13	un
Learning	65	com	Reference services	13	un
Librarians	65	com	Information competency	12	un
Assessment	63	com	Public libraries	12	un
United States of America	46	com	Library users	11	un
Higher education	45	com	Information-seeking behaviour	10	com
Digital libraries	41	un	Focus groups	10	com
Information dissemination	40	com	Marketing	10	un
Computer literacy	38	com	Motivation	10	com
Questionnaire	37	com	Needs assessment	10	com
Information management	35	com	Online learning	10	un
Bibliographic instruction	34	un	Undergraduate students	10	un
University libraries	33	un	Active learning	9	un
Critical thinking	32	un	Faculty-librarian collaboration	9	un
Information skills	30	com	Information analysis	9	un
United Kingdom	30	com	Online tutorials	9	un
E-learning	29	un	Plagiarism	9	un
Lifelong learning	28	un	Reading	8	com
Problem-based learning	27	com	Research skills	8	un
Professional competence	27	com	Competencies	7	un
Information storage and retrieval	26	un	Information needs	7	un
Standards	25	com	Information literacies	7	un
Library services	22	com	Learning styles	7	un
Web 2.0	22	un	User education	7	un
Communication	21	com	Information competencies	6	un
Evaluation	21	com	Information literacy education	6	un
Surveys	21	un	Online instruction	6	un
Information literacy instruction	19	un	Skills training	6	un
Organization and management	19	com	Abstracting	5	un
Program evaluation	19	com	Case study	5	un
Information-seeking	17	un	Information literacy skills	5	un
Media literacy	17	un	Key competencies	5	un
Educational measurement	16	un	Organizational case studies	5	un
Tutorials	16	un			

com Common generic-type descriptors present in both samples (HeS and SoS), *un* Unique generic-type descriptors only present in this sample (SoS)

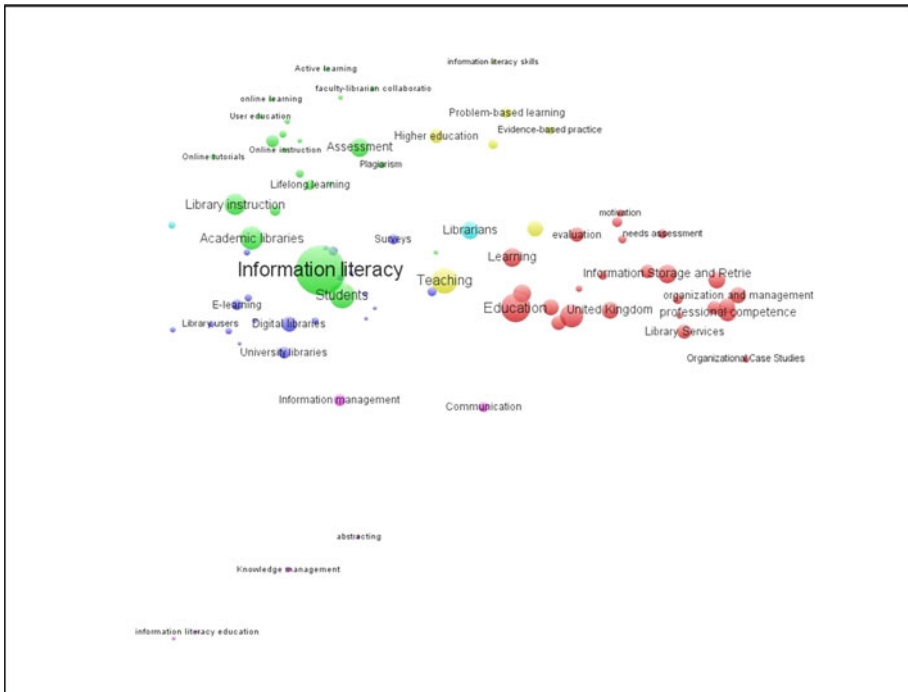


Fig. 3 Map of IL descriptor co-occurrences in SoS

that are active and focused on giving students the autonomy to solve problems related to information and learning on their own (Webber and Johnston 2000; Julien and Breu 2005; Andretta 2007; Corral 2007; Pinto and Sales 2008; Badke 2008; Jarson 2010; Shenton and Fitzgibbons 2010; Hollister 2011; among others).

Cluster 2 (green) is located to the left of the map. Its twenty-two descriptors are: “Academic libraries”; “Active learning”; “Assessment”; “Bibliographic instruction”; “Competencies”; “Faculty-librarian collaboration”; “Information analysis”; “Information literacy”; “Information literacy instruction”; “Learning styles”; “Library instruction”; “Lifelong learning”; “Marketing”; “Online instruction”; “Online learning”; “Online tutorials”; “Plagiarism”; “Research skills”; “Students”; “Tutorials”; “Undergraduate students”; and “User education”. The most frequent descriptor is “Information literacy”. One constant in library research is the principal part played by libraries and IL training. The XXI century librarian must deepen their key competencies needed as coach and educator (Beard and Dale 2010), with an especial focus on pedagogical competencies and information and knowledge management (Cvetkovic and Lackie 2009). Another major topic reflected in the literature is the library’s contribution to students’ autonomy and responsibility in learning, fostering their acquisition of the critical competencies they need for their learning process (Daugherty and Russo 2010). This learning is best contextualized in real scenarios using real information (Bruce and Hughes 2010). As one observes in the terminological map (Fig. 3), another key descriptor is “Assessment”. This is oriented at measuring students’ acquisition of information competencies. One of the various assessment strategies followed is self-assessment. It is often used as the primary method (Gross and Latham 2007; Walsh 2009; Pinto 2010, 2011; among others) or in combination with

others of a more objective nature (Patterson 2009; Brown and Kingsley-Wilson 2010). In sum, this cluster could be identified as corresponding to the following themes: Information Literacy Instruction; IL Learning; Assessment; Research Competencies.

Cluster 3 (dark blue) is located at the lower left of the map. Its nineteen descriptors are: “*Critical thinking*”; “*Digital libraries*”; “*Digital literacy*”; “*E-learning*”; “*Information competencies*”; “*Information competency*”; “*Information literacies*”; “*Information needs*”; “*Information seeking*”; “*Information seeking behaviour*”; “*Information skills*”; “*Key competencies*”; “*Library users*”; “*Media literacy*”; “*Public libraries*”; “*Skills training*”; “*Surveys*”; “*University libraries*”; and “*Web 2.0*”. The most frequent descriptor is “*Digital libraries*”. This situation reflects the growth and increasing impact of the digital library, expressed in both its delivery of new digital information services and its participation in the processes of training and mentoring in the remote learning of information competencies. This latter involves the development of e-learning platforms, virtual course planning, blended learning courses, and the design of interactive tutorials, portals, learning objects, etc. (McAvinia et al. 2008; Koneru 2010). This cluster could be identified as corresponding to the following themes: Technology; Research Methods; Users’ Informational Behaviour.

Cluster 4 (yellow) is located at the bottom of the map. Its six descriptors are: “*Abstracting*”; “*Case study*”; “*Communication*”; “*Information literacy education*”; “*Information management*”; and “*Knowledge management*”. The literature analysed emphasizes the importance of communication in the processes of information search, retrieval, and dissemination, of communication’s impact on information and knowledge management, and of the people-information-technology triad of relationships and interactions that underpin organizations’ information systems (Ellis and Desouza 2009). This cluster could be identified as corresponding to the following theme: Research Methods.

Cluster 5 (purple) is located at the centre of the map. Its four descriptors are: “*Higher education*”; “*Information literacy skills*”; “*Problem based learning*”; “*Teaching*”. The descriptor most often is “*Teaching*”. This cluster could be identified as corresponding to the following theme: Education/Teaching.

Cluster 6 (sky blue) is located to the left of the map. Its four descriptors are: “*Evidence-based practice*”; “*Librarians*”; “*Reference services*”; “*United States of America*”. In this cluster, the descriptor “*Librarians*” occupies an important position in the centre of the map, being closely associated with the descriptors “*Learning*” and “*Teaching*”. Similar to the case found in the HeS field, IL research also covers higher education. In particular, there are works on the design of teaching models aimed at fostering students’ autonomous learning and information-related problem solving (Eisenberg and Berkowitz 1990; Kuhlthau 1991; Loertscher and Woolls 2002; Markless and Streatfield 2007; Pinto 2010; Pinto et al. 2010a, b). There are also studies describing the implementation of IL courses in various degree programs, taught by both academics and librarians. Examples are the works of Singh (2005) and Brown and Kingsley-Wilson (2010) in Journalism, of Conley and Gil (2011) in Business Administration, of Thaxton (2002), Larkin and Pines (2005), and Hayes-Bohanan and Spievak (2008) in Psychology. This cluster could be identified as corresponding to the following themes: Library Services; Librarians.

As can be seen, the arrangement of the SoS descriptors differs notably from the HeS case. Now the pattern is relatively linear compared to the annular distribution of HeS. The descriptors of most weight are concentrated in Cluster 2: “*Information literacy*” and “*Students*”. There is a slight overlap between Clusters 2 and 3. Cluster 6 is spread diffusely over Clusters 1, 2, 3, and 5. The descriptors of Cluster 4 are located in a separate area.

Figure 4 shows the co-occurrence density map for the SoS field. The descriptor “*Information literacy*” (Cluster 2) is the most frequently occurring in the literature. It is closely related to the descriptors “*Skills training*”, “*Information seeking*”, “*Teaching*”, “*Digital libraries*”, and “*E-learning*”. The second area of greatest strength in the density map is that formed by the descriptor “*Education*”, which is closely related to “*Learning*” and “*Teaching*”. Finally, the descriptor “*Professional competence*”, located on the right edge of the density map, and hence having little relationship with the centralmost descriptors “*Information literacy*”, “*Teaching*”, “*Learning*”, and “*Education*”, is instead closely related to “*Information storage and retrieval*” and “*Library sciences*”.

Similarly, in Table 3, one observes that there are 33 common descriptors (present in both Tables 1 and 3) and 46 non-common descriptors (generic, but only present in the case of SoS). In this case therefore, the non-common descriptors predominate, demonstrating the lack of consistency of IL in the SoS domain when compared to its equivalent in the HeS domain.

Table 4 lists the nine descriptors with greatest link strength. Of these, five are common with the HeS sample. The other four, though generic, are non-common. The link strengths per unit of occurrence are notably lower than those of the HeS case, ranging from “*Information literacy*” (2.88) to “*Information storage and retrieval*” (13.50).

Considering the two tables (Tables 1, 3) conjointly, one finds that, of the 121 different descriptors, only 33 (27.27 %) are common to both samples, while 69 (57.03 %) are generic but non-common, being present in only one of the two branches of knowledge. The 19 (15.70) remaining descriptors are specific to HeS.

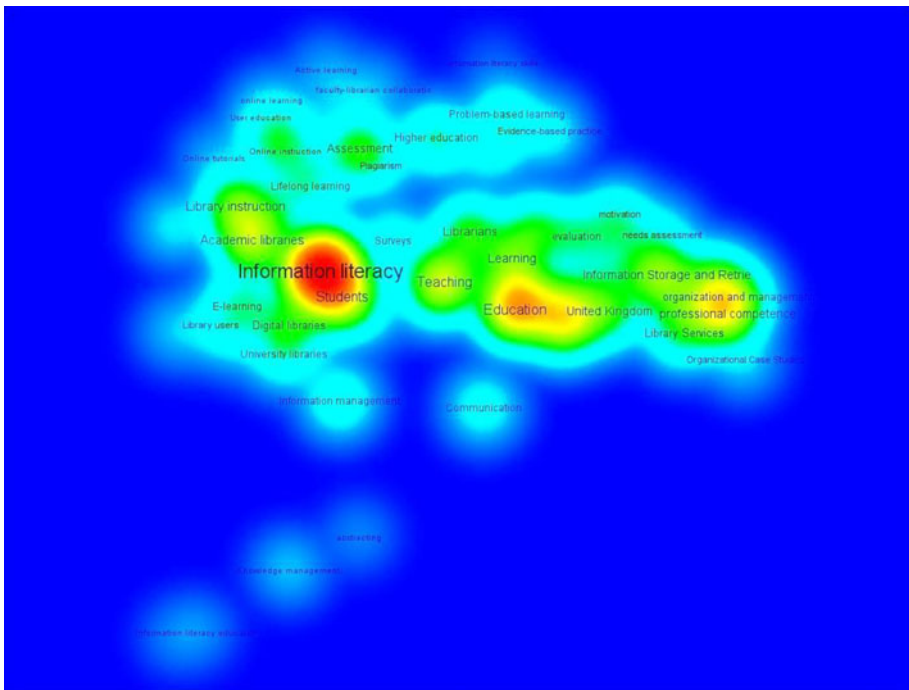


Fig. 4 Density map of IL descriptor co-occurrences in SoS

Table 4 Descriptors with the greatest link strength (SoS)

Descriptor	Total link strength	No. of occurrences	Link strength per occurrence	Cluster no.	Type
Information literacy	2,340	812	2.88	2	com
Education	839	127	6.6	1	com
Students	641	128	5	2	un
Teaching	633	101	6.26	5	com
Academic libraries	528	135	3.9	2	un
Information retrieval	526	68	7.73	1	com
Library Instruction	432	102	4.23	2	un
Information storage and retrieval	351	26	13.5	1	un
Learning	340	65	5.23	1	com

com Common generic-type descriptors present in both samples (HeS and SoS), *un* Unique generic-type descriptors only present in this sample (SoS)

Conclusions

This analysis of the scientific production on “*Information literacy*” indexed in the WoS (Thomson Reuters) and Scopus (Elsevier) databases in the period 1974–2011 has allowed concept maps of this discipline to be constructed in two quite diverse fields—health sciences and social sciences. As was to be expected, the volume of SoS documents retrieved was far greater than that of HeS. The number of descriptors detected in the two fields, however, was very similar—75 in HeS and 79 in SoS.

The 75 descriptors conforming the HeS concept map were found to be grouped into four clusters. The principal theme was “*Education*”, closely linked to “*Information retrieval*”. The first and most extensive of the four clusters of descriptors was defined by the importance for health professionals of acquiring the informational competencies for the everyday practice of their profession. The second was defined by the importance of implementing informational competencies in health sciences education. The third corresponded to work relating informational and computer competencies, probably reflecting the interdisciplinary nature of the concept of IL. The fourth cluster of descriptors corresponded to work in which evaluation in the process of acquiring information literacy is a central theme.

The 79 descriptors conforming the SoS concept map were found to be grouped into six clusters. The principal theme was “*Information Literacy*”, but the topic “*Education*” also occupied an important place in this field as it did in the case of HeS. Other major themes were “*Teaching*”, “*Learning*”, and “*Librarians*”. The first of the six clusters detected corresponded to research focused on informational education and information retrieval. The second reflected integration of the concepts of IL with the role of libraries in informational competencies training. The third corresponded to research in the development of digital libraries. The fourth was defined by everything involved in the management of information. And the fifth and sixth clusters corresponded to the importance of teaching in IL and to the role of librarians in teaching and learning IL.

It is to be expected that scientific production on IL will continue to grow in the coming years, just as it has done for several decades (Pinto et al. 2013). The rate of growth may not

be as high as before due to the increasing specialization that research will require in many fields, including the two studied in the present work.

From the results described above, it is possible to draw a number of conclusions by way of synthesis:

- It has been possible to identify the emerging research topics, which descriptors were the strongest, how they were interrelated, and the degree of development and implementation of IL during the period studied.
- The graphical representation of the results provided by the VOSViewer software show the intensity of the web of interrelationships among the descriptors analysed, their relative proximity, the shape of the graph they form, the distribution of clusters in that graph, etc.
- The analysis has provided insight into the conceptual structure of IL in research in the two quite different fields studied—HeS and SoS—during the period 1974–2011. These two research fields match substantially in the number of descriptors they have used, but not in their main concepts, of which only three were common: “*Information literacy*”, “*Education*”, and “*Information retrieval*”. Indeed, there are many more differences than similarities among the basic concepts of the two fields and their organization and categorization. The conceptual spaces are different. While HeS presents a circular type of conceptual structure, that of SoS is more linear. While HeS shows greater interest in application concepts, SoS has a focus on certain theoretical concepts. Also, HeS displays great conceptual strength, using its principal concepts in a reticular and consistent form, while SoS does so from a weak and diffuse perspective. Paradoxically, HeS, the less productive branch of knowledge of the two in work on IL, displays greater conceptual consistency since it uses a significant number of specific descriptors.

From a practical standpoint, our results indicate that the common IL concepts found in the study should be regarded as fundamental concepts that need to be consolidated and incremented.

The observed differences between the two domains confirm the “discipline dependence” of the concept of “information literacy”, with it having a specific personality in each of the two disciplines. Also, IL was noticeably more consolidated in HeS. In any case, the low percentage of descriptors that were common to the two research fields forces one to conclude that IL is, at least for the moment, a conceptual space that is still in a phase of growth and development, and is in need of higher levels of consistency and specificity. We are convinced that such higher indices will be attained with the increasing institutional implementation and development of this new discipline. Whichever the case, we are aware of the need for further research addressing the conceptual and terminological consistency of IL in depth.

References

- AASL/AECT. (1998). *Information literacy standard for student learning*. <http://www.davidvl.org/250CourseSpr04/modelaasl.html>. Accessed 3 April 2013.
- ALA/ACRL. (2000). *Information literacy competency standards for higher education*. www.ala.org/ala/mgrps/divs/acrl/standards/standards.pdf. Accessed 7 September 2013.
- Andretta, S. (2007). *Change and challenge: Information literacy for the 21st century*. Adelaide: Auslib Press.
- Badke, W. (2008). Ten reasons to teach information literacy for credit. *Online*, 32(6), 47–49.

- Bankson, H. L. (2009). Health literacy: An exploratory bibliometric analysis, 1997–2007. *Journal of the Medical Library Association*, 97(2), 148–150.
- Beard, J., & Dale, P. (2010). Library design, learning spaces and academic literacy. *New Library World*, 111(11/12), 480–492.
- Brown, C. P., & Kingsley-Wilson, B. (2010). Assessing organically: Turning an assignment into an assessment. *Reference Services Review*, 38(4), 536–556.
- Bruce, C., & Hughes, H. (2010). Informed learning: A pedagogical construct attending simultaneously to information use and learning. *Library and Information Science Research*, 32(4), A2–A8.
- Burnham, E., & Peterson, E. B. (2005). Health information literacy: A library case study. *Library Trends*, 53(3), 422–433.
- Castells, M. (2001). *La era de la información: economía, sociedad y cultura* (Vol. 2). México: Siglo XXI.
- Conley, T. M., & Gil, E. L. (2011). Information literacy for undergraduate business students: Examining value, relevancy, and implications for the new century. *Journal of Business & Finance Librarianship*, 16(3), 213–228.
- Cope, B., & Kalantzis, M. (2000). *Multiliteracies: Literacy learning and the design of social futures*. London: Routledge.
- Corrall, S. M. (2007). Benchmarking strategic engagement with information literacy in higher education: Towards a working model. *Information Research*, 12(4) paper 328. <http://InformationR.net/ir/12-4/paper328.html>. Accessed May 2012.
- Cvetkovic, B. V., & Lackie, R. J. (2009). *Teaching generation M: A handbook for librarians and educators*. New York: Neal-Schuman.
- Daugherty, A. L., & Russo, M. F. (2010). Reinforcing critical thinking and information literacy skills through assignment design. *Louisiana Libraries*, 72(3), 26–29.
- Davenport, T. H., & Prusak, L. (2000). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.
- Dudziak, E. A. (2010). Competência informacional: análise evolucionária das tendências da pesquisa e produtividade científica em âmbito mundial. *Informação & Informação*, 15(2), 1–22. <http://www.uel.br/revistas/uel/index.php/informacao/article/view/7045/6994>. Accessed May 2013.
- Eisenberg, M., & Berkowitz, R. (1990). *Information problem solving: The Big Six skills approach to library & information skills instruction*. Norwood: Ablex.
- Ellis, P., & Desouza, K. C. (2009). On information management, environmental sustainability, and cradle to cradle mentalities. *Business Information Review*, 26(4), 257–264.
- Escalona, M. I., Lagar, M. P., & Pulgarín, A. (2010). Web of Science vs. SCOPUS: Un estudio cuantitativo en Ingeniería Química. *Anales de documentación: Revista de biblioteconomía y documentación*, 13, 159–175.
- Grant, S. (2002). Information literacy and consumer health. *White Paper. Information literacy meeting of experts*. Prague, The Czech Republic.
- Gratch-Lindauer, B. (2004). Developing a tool to assess community college students. In Ilene Rockman (Ed.), *Integrating information literacy into the higher education curriculum* (pp. 165–206). San Francisco: Jossey-Bass.
- Gross, M., & Latham, D. (2007). Attaining information literacy: An investigation of the relationship between skill level, self-estimates of skill, and library anxiety. *Library & Information Science Research*, 29, 332–353.
- Hayes-Bohanan, P., & Spievak, E. (2008). You can lead students to sources, but can you make them think? *College & Undergraduate Libraries*, 15(1), 173–210.
- Head, J., & Eisenberg, M. B. (2010). *How college students evaluate and use information in the digital age*. http://projectinfolit.org/pdfs/PIL_Fall2010_Survey_FullReport1.pdf. Accessed 3 April 2013.
- Hollister, C. V. (2011). *Best practices for credit-bearing information literacy courses*. ACRL, 288 pp.
- Horton, F. W. (2007). *Understanding information literacy: A primer*” information society division, communication and information sector. Paris: UNESCO.
- Ivanitskaya, L., O’Boyle, I., & Casey, A. M. (2006). Health information literacy and competencies of information age students: Results from the interactive online research readiness self-assessment (RRSA). *Journal of Medical Internet Research*, 8(2), e6.
- Jarson, J. (2010). Information literacy and higher education. *College & Research Libraries News*, 71(10), 534–538.
- Julien, H., & Breu, R. D. (2005). Instructional practices in Canadian public libraries. *Library and Information Science Research*, 27(3), 281–301.
- Kellner, D. (2000). Multiple Literacies and Critical Pedagogies: New Paradigms. In P. P. Trifonas (Ed.), *Revolutionary pedagogies: Cultural politics, instituting education, and the discourse of theory* (pp. 2–196). New York: Routledge.

- Salem, J. A., & Radcliff, C. J. (2006). Using the SAILS test to assess information literacy. Building effective, sustainable, practical assessment: In: *Proceedings of the second library assessment conference* (Charlottesville, 2006), pp. 131–137.
- Saranto, K., & Hovenga, E. J. S. (2004). Information literacy-what is it about? Literature review of the concept and the context. *International Journal of Medical Informatics*, 73(6), 503–513.
- Schwarz, R., & Wojtezak, A. (2003). Una vía hacia la educación médica orientada a las competencias. *Educación Médica*, 6(2), 5–10. July–Sep. <http://dx.doi.org/10.4321/S1575-18132003000400002>. Accessed 4 April 2013.
- Shapiro, R. M. (2010). *Health literacy: A bibliometric and citation analysis*. University of Kentucky Master's Theses. Paper 71. http://uknowledge.uky.edu/gradschool_theses/71. Accessed 4 April 2013.
- Shenton, A. K., & Fitzgibbons, M. (2010). Making information literacy relevant. *Library Review*, 59(3), 165–174.
- Singh, A. B. (2005). A report on faculty perceptions of students' information literacy competencies in journalism and mass communication programs: The ACEJMC survey. *College & Research Libraries*, 66(4), 294–310.
- Spitzer, K. L., Eisenberg, M. B., & Lowe, C. A. (1998). *Information literacy essential skills for the information age*. Syracuse, NY: ERIC Clearinghouse on Information & Technology, Syracuse University. <http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED427780>. Accessed 4 April 2013.
- Thaxton, L. (2002). Information dissemination and library instruction in psychology revisited. *Behavioral & Social Sciences Librarian*, 21(1), 1–14.
- Van Eck, N. J., & Waltman, L. (2007). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538.
- Van Eck, N. J., Waltman, L., Dekker, R., & Van den Berg, J. (2010). A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *Journal of the American Society for Information Science and Technology*, 61(12), 2405–2416.
- Virkus, S. (2003). Information literacy in Europe: A literature review. *Information Research*, 8(4), paper no. 159. <http://informationr.net/ir/8-4/paper159.html>. Accessed 4 April 2013.
- Walsh, A. (2009). Information literacy assessment: Were we do start? *Journal of Librarianship and Information Science*, 41(1), 19–28.
- Webber, S., & Johnston, B. (2000). Conceptions of IL: New perspectives and implications. *Journal of Information Science*, 26(6), 381–397.