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CHAPTER 2

The Nature of Information Literacy

It is rather obvious that researchers are or should be informed citizens, not only in their everyday life but also in their professional work. This means that relying on a number of literacies is foundational to the work of today’s researcher. To gain a more accurate picture of the nature of these literacies, we can consider them from a bird’s-eye view. Such a perspective reveals three levels of literacy:

- conceptual competencies that include innovative thinking, problem-solving, and critical thinking;
- human competencies: social networking skills, self-management, and cross-cultural interaction skills;
- practical competencies: including learning skills and information literacy (Lee, 2013).

The best-known literacy from among practical competencies is information literacy.

DEFINITIONS, DECLARATIONS, AND FRAMEWORKS

The terms information literacy and information literate were coined by Zurkowski (1974) to refer to people who are able to solve their information problems by using relevant information sources and applying relevant technology. As Pinto, Cordón, and Diaz (2010) point out, information literacy has stimulated considerable, long-standing interest throughout the second half of the twentieth century, and more significantly from the 1980s onward. This is shown by the number and variety of publications, regularly reviewed by Johnson et al. (2012), among others.

Zurkowski’s work was the formative moment for information literacy. His approach logically perceived information literacy as a programmatic aim, and placed libraries and librarians at the core of this effort. The advent of bibliographic databases ushered in a new era of research. Early databases required significant additional technological know-how, often possessed by
Researchers only. This decisive intermediary role diminished with the appearance of CD-ROMs in the 1980s and finally vanished with the arrival of social media tools.

Zurkowski and other early writers on the topic were undoubtedly right to see that the changes in the research landscape would result in a situation in which researchers would be left without knowledge of the technologies of searching. These new methods of searching were indispensable, and without them researchers would have remained practically functionally illiterate in seeking academic information. Naturally, this required education.

When databases became searchable and usable by non-experts, the role of librarians as teachers of research skills was well established. The meaning of information literacy as a theory as well as a practice had yet to be clearly articulated. The appearance of the ACRL Competency Standards in 2000 was an important step forward, as it could be used to show information literacy in all its complexity, laying out achievable objectives. Information literacy became a full-fledged practice with theoretical backing.

In the meantime, information seeking has become a daily activity as “googling” is employed with unbelievable frequency. However, this does not question the validity of information literacy. The question is whether we should “refocus our efforts on the educational, cultural, and technological shifts in which ‘information literacy’ per se becomes a somewhat arbitrary label for the very stuff of learning and information discovery in today’s academic (and larger) world” (Cowan, 2014, p. 28).

In a more general context, we can say that the increase in available materials not only caused changes in collection management practices, but also drove the need for information literacy (Palmer & Gelfand, 2013).

Definitions and descriptions of information literacy (IL) can be summarized as referring to

1. the use of information and communication technologies (ICTs) to retrieve and disseminate information;
2. the competences to find and use the information in information (re)sources;
3. the process of recognizing information need, and finding, evaluating, and using information to acquire or extend knowledge.

The third option is the most comprehensive and most useful, as it includes both the use of ICT and the information (re)sources concept (Boekhorst, 2003).

Perhaps the best known and widely accepted definition of IL says that information literate people are able to recognize when information is needed. They are also able to identify, locate, evaluate, and use information to solve
a particular problem (ALA, 1989). This definition has been widely used and further developed by other definitions.

In their foundational work, Johnston and Webber (2003, p. 336) provide the following definition of information literacy:

*Information literacy is the adoption of appropriate information behaviour to obtain, through whatever channel or medium, information well fitted to information needs, together with critical awareness of the importance of wise and ethical use of information in society.*

They identify four major goals for information literacy in the information society:

- information literacy for citizenship, including engagement in development by freedom of access to and critical use of data and information;
- information literacy for economic growth that stimulates the development of new and existing enterprises by intensive and creative use of information and knowledge;
- information literacy for employability;
- information literacy for personal growth and creativity, which cuts across and contributes to achieving all the above goals (Webber & Johnston, 2000).

Our previous discussion has demonstrated that all four goals are valid in the research environment. Obviously, the weight of these goals differs to some degree. If we take the role of the researcher as a citizen, we have to say that there is no room in this book for outlining this issue in its entirety and we do not intend to do so. Nonetheless, we have already pointed toward this role and mentioned developments to achieve citizen science and open science or open access, just to name a few. Critical use of information and data is crucial for information literacy and thus has found its place in this book and plays a major role in it. Without wanting to be exhaustive again, there is hardly any doubt that research contributed to economic growth and development in general. Intensive and creative use of information and knowledge is very much the essence of research. IL may not influence employability directly, but writing this book would make little sense if we did not believe in its importance. The relevance of personal growth and creativity is unquestionable, especially as they affect all the goals above.

IL education emphasizes critical thinking (appearing in several places throughout this book, especially in the section about reading and writing) and the necessity of being able to recognize the quality of a given message. It is firmly positioned among other literacies despite a certain amount of (occasionally well-founded) skepticism, which in itself highlights the fact that information literacy and especially its lack has always been of greater
importance to academic librarians than to any other group of “players” in the information and education arena (Bawden & Robinson, 2009).

Different models approach information literacy from different viewpoints. The Seven Faces of Information Literacy in Higher Education, conceived by Christine Bruce in 1997, concentrates on experiencing information literacy (Bruce, 1997). From a different point of view, we will come back to this model.

Using Vannevar Bush’s vision of the technologically connected and enabled researcher who plays key role in the information society, Johnston and Webber (2005) propose information literacy as a soft applied discipline. They contrast this approach to the characterization of information literacy as a personal attribute. As we will demonstrate, they are not the only ones directing attention to the importance of information literacy aimed at research and researchers.

From among the numerous conceptual models of IL, we will take the approach that differentiates between three levels, that is, macro, micro, and meso, and places culture on the macro-level. The meso-level is composed of different information subcultures, and the micro-level represents the so-called individual playground. The meso-level materializes in concepts such as the information culture of individual organizations. The micro-level is entirely individual.

There are also several process models that address information literacy on a general level in the educational and library environment, as identified by Wai-yi (1998) and Uribe Tirado and Caño Muñoz (2012).

Markless and Streatfield (2007) offer a model that consists of three elements:

• connecting with information (orientation, exploring, focusing, locating);
• interacting with information (thinking critically, evaluating);
• making use of information (transforming, communicating, applying).

The Big Six model (Eisenberg & Berkowitz, 1990) contains the following six stages of problem-solving with two substages under each:

1. Task definition
   1.1. Defining the information problem
   1.2. Identifying information needed
2. Information seeking strategies
   2.1. Determining all possible sources
   2.2. Selecting the best sources
3. Location and access
   3.1. Locating sources (intellectually and physically)
   3.2. Finding information within sources
4. Use of information
   4.1. Engaging (e.g., read, hear, view, touch)
   4.2. Extracting relevant information

5. Synthesis
   5.1. Organizing from multiple sources
   5.2. Presenting the information

6. Evaluation
   6.1. Judging the product (effectiveness)
   6.2. Judging the process (efficiency).¹

Coming from the world of different literacies more or less closely connected to IL, there are some higher order abilities and activities that can be used when thinking about information literacy, especially in the world of research. These skills broaden the models of IL by adding several new dimensions to them. Information literate people thus are required to effectively communicate verbal and visual information in oral and written form, in their native language and in a second (foreign) language (AACU, 2002; Bundy, 2004a, 2004b).

The activities required from information literate people are as follows:
• choosing a communication medium and format that best supports the purposes and the intended audience;
• using a range of information technology applications in creating the product or performance;
• incorporating principles of design and communication;
• communicating clearly and with a style that supports the purposes of the intended audience (ACRL, 2000).

All the above skills and abilities build a foundation for higher-level skills that not only reflect those abilities but also go beyond them. These higher-level skills can be summarized as follows:
• transforming information into knowledge and knowledge into judgment and action (AACU, 2002);
• recognizing, understanding, and analyzing the context within which language, information, and knowledge are communicated and presented;
• understanding the relationships among language, knowledge, and power;
• using appropriate technologies to manage information collected or generated for future use;
• critiquing our own and others’ works (D’Angelo & Maid, 2004).

There is an organizing heuristic, which views information literacy as a product of its time. It is called *kairos* and demands that we understand

all truth claims “as embedded in a context, and all actions as measured responses to that context” (Drabinski, 2014, p. 481).

It is rather self-explanatory that different declarations also play an important role in the life of information literacy, the content of some of which are outlined here. While containing significant statements on important issues, the Lyon Declaration on Access to Information and Development (IFLA, 2014) is not concerned with issues, related to research. Nevertheless, it is useful to contemplate one of its statements:

*Increased access to information and knowledge, underpinned by universal literacy, is an essential pillar of sustainable development. Greater availability of quality information and data and the involvement of communities in its creation will provide a fuller, more transparent allocation of resources.*

This statement points to the fact that—as outlined above—besides information, data has come to the foreground of attention. Nonetheless, the main emphasis of this statement is on the connection between literacy and quality information that is of prime interest for research.

The Declaration also underlines the role of information intermediaries in “connecting stakeholders across regional, cultural, and other barriers to facilitate communication and the exchange of development solutions that could be scaled for greater impact.” We can recognize here that this has meaning for scientific research that is global and the major group of stakeholders comprises researchers.

The two information literacy frameworks that are the most relevant for our purpose are the Information Literacy Competency Standards for Higher Education, conceived by the Association of College and Research Libraries (ACRL, 2000) in the United States of America and the Society of College, National and University Libraries (SCONUL) Seven Pillars of Information Literacy, Core Model for Higher Education, devised by SCONUL (2011) in the United Kingdom. Although we do not intend to analyze them in any detail here, they (especially the latter) are referred to several times throughout this book.

There is also another framework which provides an example to illustrate the distinguished role of information literacy in the researcher’s life. It is the Vitae Research Development Framework, which defines the knowledge, behaviors, and attributes of the effective and highly skilled researcher. It operates with lenses that focus on knowledge, behaviors, and attributes that are developed or acquired through, or used in, the broader contexts of being a researcher. The information literacy lens is one of a series of lenses that address, among other issues, employability, leadership, public engagement, and mobility.
The framework approaches information literacy in its “knowledge base” domain. IL is described in three phases. It puts the use of information technology into first place, while emphasizing the need to obtain expert advice from information or data managers, archivists, and librarians.

The second phase develops awareness of the creation, organization, validation, sharing, storing, and curation of information and/or data, as well as an understanding of the legal, ethical, and security requirements. Somewhat surprisingly, knowledge on the purpose of metadata appears in this domain. Phase three focuses on advising and educating peers, less experienced researchers, students, and staff in the above requirements. The final phase is about developing new techniques and anticipating trends.

The information literacy lens underlines that IL is necessary not only for finding, analyzing and evaluating data, and searching for literature, but for publishing as well. These qualities are fundamental to the whole process of research.

This lens may be used by the researchers themselves, who can identify:

• how information literacy can contribute to their professional development;
• how the skills and attributes they have developed through research can contribute to their development in information literacy;
• which areas of IL they need to develop to be more effective.

It also provides evidence of the transferability of their information literacy skills in their CV, in job applications, and at interviews.

This lens also may be used to:

• demonstrate how information literacy can contribute toward the overall professional development of researchers;
• enable researchers to recognize how useful and transferable is the learning they have acquired through information literacy related activities;
• explore how the Vitae Researcher Development Framework relates to the SCONUL Seven Pillars of Information Literacy and vice versa (Vitae, 2011).

THE NEW LITERACIES CONTEXT

Livingstone, van Couvering, and Thumin (2008) identify several purposes of literacies:

• fostering democracy, participation, and active citizenship;
• contributing to knowledge economy and competitiveness in the information economy;
• supporting lifelong learning and personal fulfillment.
They add that information and media literate individuals are not only likely to have more to offer and achieve, but also are more able to make proper choices from the rich array of offers for the consumer.

The concept of *new literacies* comes from New Literacy Studies, a body of work that “has approached the study of literacy not as an issue of measurement or of skills but as social practices that vary from one context to another” (Street, 2008, p. 420).

According to the apparently most widely accepted definition in this vein by Street (1984, p. 1), literacy is conceived as “social practices and conceptions of reading and writing.”

This social nature of literacy is expressed by Johnson (2011) as follows:

*Our concept of literacy changes every time there’s a major shift in information technology. Being literate used to mean knowing how to sign your name. At one point it meant the ability to read and write Latin. Today, being literate generally means being able to read and understand a newspaper in your own language.*

These social practices have been magnified by the growing role of digital technologies (Livingstone, 2004). A number of literacies can be identified within varying social contexts and under varying social conditions.

The nature of these different literacies is changing within the conditions of textual work, that is, reading and writing. They also depend on varying social contexts and equally varying social conditions. Consequently, they change with time, according to the changing purposes and circumstances, as well as the people and tools involved (Lankshear & Knobel, 2004).

For all these changing circumstances, a rapid development of information and communication technologies represents one of the most crucial factors.

The formulation of literacies as social practices led to the appearance of the following requirements:

- Literacies must be foundational capabilities on which particular skills depend. Consequently, literacies and their lack will have a lifelong and life-wide impact.

- Extended literacy practice should be developed continuously, thus they are acquired through continued development and refinement in different contexts.

- Digital practices that emerge in complex situations will involve an interaction between personal capabilities or dispositions and the environment supporting action. Transferring digital capabilities from one environment to another is more problematic than has been acknowledged. Consequently, the transfer from social life to research environments that may happen with the use of social media is problematic.
• Literacies must influence individual identity, specifically on the way a stance toward knowledge in digital forms is adopted.

• Literacies are continually evolving in response to technical, epistemological, and cultural changes (Littlejohn, Beetham, & McGill, 2012).

Information literacy and other (related) literacies are seen as new literacies on account of their orientation toward new informational, technological, and societal realities (Buschman, 2009). Leu et al. (2004) provide a review of the roles of literacy that illustrates this. For instance, as agricultural technologies improved thus allowing the Sumerian civilization to expand, it became necessary to record business transactions and tax records. This social necessity prompted the development of the first writing technology.

In medieval Europe, the Christian church used literacy as a vehicle to enforce its religious viewpoint with the help of a literate priesthood, which was able to faithfully copy, read, and interpret common religious texts.

Literacy became much more widespread as Martin Luther argued for the need for individuals to read and directly access religious texts on their own. Reformation went hand in hand with the development of printing technologies.

Street (2008, p. 7) reminds us of the following: “One response to the growing role of technologies of communication in our lives is to overstate their ability to determine our social and cultural activity.” He adds that such models were rooted in assumptions about technological determinism, which have later been challenged and discredited.

Nevertheless, Internet technologies and digital forms of communication brought the same thinking back and it is difficult to take sufficient account of the technological dimension of new literacies without such determinism. On the other hand, the pervasive influence of information technology may be regarded to be real and has to be approached taking its complexity into consideration.

This thinking is built on the idea that technological determinism is a pure theoretical position, which tries to understand general patterns of social and cultural change. However, we do not need to choose between different vocabularies and overall frameworks to follow the pervasive nature of the latest information technology solutions (the Internet per se, the mobile communication technology, the ubiquitous computer including embedded systems and sensors, nano- and bioinformatics, etc.). We also need to have a broad picture of future technologies to be able to redesign the “old” information literacies and get ready for new ones.
The historical development of literacy clearly shows that there is a difference between being able to appreciate and process an esthetically valuable piece of writing and to cope with present-day socio-technological changes and challenges (Livingstone, van Couvering, & Thumin, 2008). This is one of the reasons why the existence of the World Wide Web and then also the appearance of Web 2.0 have been playing a significant role in forming literacies.

Web 2.0 is generally taken to encompass a variety of sites and tools for shared information creation and updating, and social networking and communication (Bawden & Robinson, 2009). It enables mass participation in social activities. Users and their interests are represented in mediated spaces, which also serve as an environment to activate engagement with others (Jarrett, 2008).

New literacies thus are tied to new technologies, that is, ICTs. While this is true, they also remain related to culture. The fact that being literate also denotes having erudition and being educated verifies this. However, even this boundary is of a dual nature as the Internet and other forms of information and communication technologies are redefining the nature of reading, writing, and communication. ICTs will continue to change in the years ahead, continuously requiring new literacies to exploit their potential. Information literacy also shows these signs of being Janus-faced.

Beyond recognizing that new literacy skills and practices are required by each new ICT as it emerges and evolves, it is our responsibility to integrate these new literacies into the appropriate curricula (IRA, 2009).

The dimensions of literacy have broadened. The complexities of the current information environment require complicated and broad forms of literacies that are not restricted to any particular technology and that foster understanding, meaning, and context (Bawden, 2001).

Literacies are multiple, multimodal, and multifaceted (Coiro et al., 2008). Contemporary concepts of literacy include visual, electronic, and digital forms of expression and communication. As its scope has broadened, literacy is tied both to technology and culture, and the ability to become and remain literate requires a long-term commitment. Long-term commitment, usually identified as lifelong learning, is the third attribute that also strongly determines information literacy (Cordes, 2009).

According to Leu et al. (2007), our view of literacy, limited to decoding and encoding, reading and writing, or even to producing texts of different genres appropriate to different situations, should be broadened to developing a set of composite skills that will enable learners to decode
and negotiate critically the cultural, social, political, and ideological aspects of language use. They also argue for multiple literacies, which include the ability to use reading and writing skills in order to produce, understand, interpret, and critically evaluate multimodal texts.

Taking the concept of *deixis*, used by linguists to define words whose meanings change rapidly as their context changes, we can say that the meaning of literacy has become deictic because we live in an age of rapidly changing information and communication technologies. Having been literate in a world defined primarily by relatively static book technologies does not ensure that we are fully literate today. To be literate tomorrow will be defined by newer technologies that have not yet appeared (Leu et al., 2013).

Literacy education is not about skill development and deep competence, but it is

*about the institutional shaping of social practices and cultural resources, about inducting successive generations into particular cultural, normative ways of handling texts, and about access to technologies and artefacts (e.g., writing, the Internet) and to the social institutions where these tools and artefacts are used (e.g., workplaces, civic institutions)*

*Luke and Freebody (1999).*

The purposeful social nature of this shaping activity comes to the fore when we underscore that literacy means participating in understanding and composing meaningful written, visual, and spoken texts, as well as using them functionally by negotiating the social relations around them. This includes the understanding that these functions shape the way texts are structured. Such understandings include critically analyzing and transforming texts (Luke & Freebody, 1999).

When arguing for a broad view of information literacy, we can put the accent on knowledge generation and take a knowledge management (KM) perspective, which considers information related to tacit knowledge among other factors in the context of academia (Tirado & Muñoz, 2012).

**THE READING AND WRITING CONTEXT**

Information literacy is closely related to *reading literacy*, which, despite its name, involves the integration of listening, speaking, reading, writing, and numeracy. It can be defined as an individual’s ability to understand printed text and communicate through print. These also have a close relationship with *functional literacy*, which most commonly denotes the ability to read and use information essential for everyday life (Bawden, 2001).
Peter Morville, a pioneer and one of the best known figures of information architecture, findability, and user experience of research and practice, emphasizes that mastering the skills of written communication—which, by definition, includes reading and writing—is required for efficiently functioning in modern society (Morville, 2005).

In a similar vein, the High Level Group on Literacy, commissioned by the European Union affirms that the digital world is centered on the written word. Even if digitization has added entirely new dimensions to our ways of connecting and communicating, the written word stands at the center of these new dimensions as the common denominator.

This circumstance makes literacy more and more interconnected with our lives in a digital world, where large numbers of people lack the necessary reading and writing skills to make use of it. Literacy competences thus become more central to our work as well as our private and social.

In addition to this, the very nature of literacy is changing, as the digital world requires higher-order problem-solving skills. Reading online demands a greater ability to evaluate information critically, available in unprecedented greater quantity and variety than ever before. There is also a need for the ability to extract and use knowledge from online resources (EU, 2012).

The necessary but not sufficient “roles” for the reader in a postmodern, text-based culture are the following:

- code breaker;
- meaning maker;
- text user;
- text critic.

The role of the code breaker requires competence in coding and decoding. The prerequisite of being a meaning maker is semantic competence. Being a text user in this context presupposes that we have pragmatic competence. Not surprisingly, texts critics have to have critical competence (Luke & Freebody, 1999).

In the latter case, perhaps the plural would be better, i.e., critical competences.

These roles do not seem to differ fundamentally from those of reading in a print environment. Coding and decoding enables the use of texts and is overlaid by the search for meaning. In research environments—both print and digital—part of the coding is different as the language of science is a unique hybrid that consists of natural language extended by and embedded in a language of meaningful specialized actions afforded by the technological environments in which science is conducted. The latter part of this
hybrid is much more a meaning-making system than a language in the linguistic sense (Lemke, 2004).

Researchers are as much texts users and text producers as they are text critics. While this is also true in the print environment, our focus on information literacy and Research 2.0 dictates emphasizing that these roles should be and indeed are continued in digital environments, even if under different circumstances.

The requirement of being a text critic points toward critical reading. However, before discussing it in more detail, let us direct attention toward the fact that, while the actual processes of doing research work differ by discipline and institution, all of them involve a distinctive methodological orientation which values critical reflection, the cumulative aggregation of knowledge and understanding, an emphasis on evidence and reliability, and the ethic of enquiry.

The combination of these characteristics distinguishes the construction of scholarly knowledge from other kinds of knowledge production such as factual knowledge, practical knowledge, common sense, morality, or the wisdom of the crowd (Goodfellow, 2013).

In the case of information literacy, critical reading is required which is based on critical thinking. Although critical reading is one of the abilities and activities enumerated above, its special importance requires separate discussion.

In his foundational work on digital literacy, Gilster (1997) underlines the view that critical thinking means distinguishing between content and its presentation. In 2013, the ACRL reinforced the belief that critical thinking has been central to information literacy, and that it continues to be a core value in teaching new literacies (ACRL, 2013).

If we follow the work of Jones (1996), other abilities required for critical thinking can be enumerated as follows:

- differentiating between fact and opinion;
- examining underlying assumptions, including our own;
- looking for explanations, causes, and solutions;
- being aware of fallacious arguments, ambiguity, and manipulative reasoning;
- focusing on the whole picture, while examining the specifics;
- looking for reputable sources.

Taking these into consideration, Beeson (2005) suggests a number of questions we can ask:

- What is the author trying to state (say, write)?
- Why are they stating it?
- Who else is stating similar or different things?
- Why should we believe any of them?
All the above steps lead us toward an evaluation of reliability, validity, accuracy, authority, timeliness, and point of view or bias as well as a recognition of prejudice, deception, or manipulation by examining and comparing information from various sources supplemented by an analysis of the structure and logic of the supporting arguments or methods (ACRL, 2000).

Critical thinking raises complex questions about criticizing our own thinking, either from an egocentric or a socio-centric point of view (Elder, 2011).

In the case of the researcher, it would appear to be self-explanatory that decisions related to the domain of information literacy are governed by socio-centric views defined by professional communities (of knowledge) to which the individual is attached. Obviously, a researcher has a number of personal motivations. Nonetheless, these latter seem to fall outside the sphere of decisions taken from the point of view of IL.

According to Jones (1996), critical reading consists of:
• determining the purpose of the text and assessing how the central claims are developed;
• making judgments about the intended audience of the text;
• distinguishing the different kinds of reasoning in the text;
• examining the evidence and sources of the writing; Lynch (1998) adds two more features:
• assessing bias;
• assessing accuracy.

Besides the broader framework of information literacy, critical reading applies to abstracting, which has its own complex relationship with IL. Put simply, abstracting is the activity of writing abstracts that are texts that contain the most important content of existing, another texts in concise, condensed, and abbreviated form (Koltay, 2009). Despite this apparent simplicity, abstracting is one of the higher-level activities of information literacy as maintained by Pinto, Fernández-Ramos, and Doucet (2008).

When we write abstracts, we have to concentrate on deciding what is important in a text. The extraction and summarizing of information play an important role in many forms and phases of communication (Loo & Chung, 2006), and the usefulness of abstracting from the point of view of IL is based on the fact that abstracting employs decoding and encoding as well as critical reading (Guinn, 1979).

Generally, we have to be aware of the fact that knowledge on abstracting pre-dates that on IL. In his book on abstracting, Cremmins (1982), for example, stresses the importance of critical reading, without even mentioning IL. Abstracts serve as important tools in decisions about relevance, thus
being information literate supposes an ability to find information and to compare it to the searcher’s purpose and interests. In other words, information literacy requires decisions on the relevance of information found in literature searches.

Abstracting, as an activity, fits well into the system of scholarly communication because researchers who publish papers in the scholarly journals of their respective fields of knowledge are usually required to write abstracts of their own articles. The processes related to writing these so-called author abstracts does not seem have changed with new developments in scientific communication.

Even though we are focusing on selecting information here, it has to be made clear that, as a result of its complexity, abstracting also means text production with the underlying professional activities of analysis and synthesis (Alonso & Fernández, 2010). It is also closely related to academic literacy (Koltay, 2009; Ondrusek, Thiele, & Yang, 2013) that will be addressed in the next section.

As seen from the definitions and the above discussion, identifying, locating, and evaluating information, in other words information seeking, stands in the very heart of IL. Information seeking, however, is embedded in writing (Attfield, Blandford, & Dowell, 2003).

Besides developing their capacity to understand and evaluate the work of others, information literate people need skills in articulating and explaining their thoughts. They have to able “not only to navigate the Web effectively but also to integrate new information into a personal corpus which is communicable to others” (Beeson, 2005, p. 216). Integrating new information with prior information and knowledge is undoubtedly crucial (Loo & Chung, 2006).

Writing is influenced by a whole range of factors such as the broader situational and pragmatic context in which the text production tasks are embedded and the circumstances of the immediate text production. Scientific texts are firmly embedded in the historically and culturally influenced institution of science. The criteria of acting in a scholarly community are based on this (Jakobs, 2003).

As writing includes organizing, storing, designing, and creating information, as well as communicating and distributing it, information literate people are unavoidably writers as well as readers (Dashkin, 2003). Lynch (1998) adds to this insight that information literacy includes text authoring in a full range of genres including visual and multimedia communication.
From the perspective of writing, information seeking and information behavior in general are embedded processes. Conversely, seen from the perspective of information seeking and information behavior, writing is a common motivating activity (Twidale, Gruzd, & Nichols, 2008). Reflecting on texts includes information seeking as an analytic activity as any writer is devoted to the task of turning ideas into text. They then read the text to form new ideas and to make decisions about what has to be written (i.e., synthesized) and how it should be organized (Attfield, Blandford, & Dowell, 2003).

Researchers’ writing activities are closely related to disciplinary (disciplinary) communities and disciplinary discourse. Holschuh Simmons (2005, p. 297) summarizes what we know about disciplinary discourse, including the ways in which “members of a particular discourse community write, read, speak, and research, as well as the assumptions that they make and the epistemologies with which they craft their arguments.”

Academic writing is a pronouncement of membership in a particular discourse community, which is not unchanging as researchers construct, reconstruct, and deconstruct the discourse of the given community with their contributions. Consequently, this discourse is not static but is formed by negotiations between the established and dominant norms of the community and newly introduced perspectives.

A substantial part of the time dedicated to research is dedicated to writing. Successful academic writing, in general, depends on the individual writer’s projection of a shared professional context. This is also true for researchers, one of whose principal occupations is writing. Accordingly, there is interest in knowing how researchers fulfill their writing functions (Hyland & Salager-Meyer, 2008).

It would be impossible and perhaps unnecessary to give a full picture of these functions here. Nevertheless, modern approaches to literacy suggest that writers need to embed their writing in a particular social world. This behavior is a mediated interaction that comprises making use of communication channels and technologies by purposeful activities (Scollon, 1998).

According to Hyland and Salager-Meyer (2008), scientific writing has been studied principally from four perspectives. Applied linguists have largely focused on the informational, rhetorical, cross-linguistic, and stylistic organization of written texts for descriptive or pedagogic purposes. Librarians and library and information science (LIS) researchers have focused on the
role of texts in the classification, manipulation, retrieval, and dissemination of information. Historians, including several applied linguists, have been interested in the rhetorical evolution of the research article. Sociologists have investigated the interactions between researchers to explore the processes which maintain social order.

The range of written academic genres studied includes article abstracts, scientific letters, acknowledgments, theses, book reviews, conference abstracts, as well as various other genres such as article submission letters, grant proposals, and editors’ responses to journal submissions.

As Hjørland (2002) points out, the achievements of composition studies and genre analysis are fruitful for LIS, not only on the concrete but also on the methodological level. The latter is connected with the emphasis on the social and historical dimensions of communication, including the concept of discourse communities (for instance in such foundational works as John Swales’ *Genre Analysis* (Swales, 1990)).

Emphasis on discourse communities is one of the reasons why information literacy education shows a number of commonalities with the *Writing Across the Curriculum* (WAC) movement and why both can benefit from collaborating with and learning from the other (Elmborg, 2003). This movement views academic disciplines as discourse communities, each with its own set of assumptions about how knowledge is produced, while keeping in mind that new members of these communities have to do research and write like the specialists who inhabit these communities. WAC does not lose sight of social conventions of research, including the ways of articulating disciplinary knowledge as “content.”

Last but not least, WAC stresses the dialogic nature of knowledge, that is, it is negotiated in the discussions, disputes, and disagreements of specialists (Elmborg, 2006).

A different accent is set by linguistic investigations into abstracting (just mentioned above), which show that the success of author abstracts depends not only on subject knowledge but also on linguistic competence and knowledge of the appropriate structure of genres (Busch-Lauer, 1995; Cross & Oppenheim, 2006). This is true for scientific research and its genres in general as well.

Communicating information means not only finding texts but also recombining pre-existing information by selecting, arranging, and filtering, instead of creating original texts (Geisler et al., 2001). This is one of the reasons why the nature of writing related to research is often reproductive
in the sense that it requires scholars to possess “a good multi-dimensional synthetic thinking, which helps them create meaningful new combinations from existing information.” The framework for this thinking is given by reproduction literacy (Eshet-Alkalai, 2004, p. 98).

According to Jakobs (2003), scholarly communication often includes reproductive writing that is characterized by the interaction of receptive, reproductive, and productive processes. It covers all forms of writing which involve the use of other texts. It may convey the contents of other texts, such as the writing of abstracts (mentioned on the previous page) or be part of more complex text production processes.

Recourse to other texts in academic writing is not only a possibility, but it represents a prototypical and indispensable constituent of text production, provided that loans from other texts are clearly identified as such. It is not by chance that academic literacy includes the closely interrelated issues of citing and plagiarism, which is in line with requirements for those who are information literate to use information ethically (Bawden, 2001; Bundy, 2004a, 2004b).

The pursuit of familiar material in a broader sense than reproductive writing is a typical feature of the information behavior of researchers. It occurs when an information seeker has some prior experience of the specific material being sought. This may include the investigation of journals recently published in a given field, sometimes paying special attention to a certain paper. A researcher may find only peripheral relevance in that paper, then—some time later—may rediscover and re-evaluate the paper in line with changes in emphasis in their research. Sometimes, it is only a part of the paper, a single argument or assertion that is important to them. Obviously, researchers also look for new material (Shenton, 2009).

Bronshteyn and Baladad (2006) remind us that joining writing instruction with information literacy education has to go beyond the issues of finding and citing resources. In the particular case of paraphrasing exercises that they present, they stress that understanding and mastering the basic concepts of paraphrasing is key to evaluating and effectively using resources, two key tenets of information literacy.

An interesting perspective on the linguistic study of scientific writing begins with analyzing the strategies that bloggers use to communicate scientific discourse in science blogs. The results of Luzón (2013) show a blending of discursive practices from different discourses. The strategies used involve adjusting information to the readers’ knowledge
and information needs, while deploying linguistic features typical of personal, informal, and dialogic interaction.

**ADDITIONAL CONTEXTS AND TURNS: CULTURE, LIS, AND OTHERS**

First of all, we have to examine the *cultural context* of information literacy. Cultural dynamism and diversity dictate that literacies go beyond the traditional basics of reading and writing, so literacy comprises variables and communication strategies that are in accordance with the cultures and social languages of technologies, functional groups, and types of organization (Cope & Kalantzis, 2009b).

This is the reason why new literacies, such as media literacy, digital literacy, and especially information literacy, form the basis of acquiring culture in a wide sense, since they are broad in scope. They are tied not only to culture but also to technology (Cordes, 2009).

There is also an interrelation between active engagement in the cultural sphere and the uses of information, if we speak about information-as-thing (Buckland, 2012).

In accordance with this, creating a culture of semantic researchers requires that we accompany scientific training with education in data literacy and information literacy in order to establish a new cultural standard, especially because researchers often do not realize that their own scholarly communications constitute a primary source of data (Haendel, Vasilevsky & Wirz, 2012). (Data literacy will be addressed in more detail in the following section of this chapter).

The norms of the disciplinary communities mentioned above go far beyond the pressures of the “publish or perish” culture, which heavily influences the choices involved in communicating research. The culture of disciplinary communities originates in their traditions, customs, practices, beliefs, and morals, as well as the symbolic forms of communication (Elmborg, 2006).

Culture can be interpreted as a complex of codes and meanings on which human communication depends (Buckland, 2012). In other words, we can speak about culture as a “complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society” (Tylor, 1871, p. 1).

As a shared, learned, and symbolic system of values, beliefs and attitudes, culture shapes perception and behavior, and depends on the capacity for symbolic thought and social learning (Wilson et al., 2011).
Accordingly, the ability to understand data-based reasoning, already mentioned in the section on researchers’ skills and abilities can be regarded as undoubtedly cultural in its nature. Communities of disciplines define culture in research settings. Big data also has its cultural aspect, as it is a technological and scholarly phenomenon that rests on the interplay of technology, analysis, and mythology.

The evidence of what culture is made of is also expressed in the naming conventions of literacies. The Hungarian term, információs műveltség shows that importance can be attached to being educated and erudite, which also shows the influence of thinking in terms of culture. In addition, among the numerous Polish equivalents of information literacy, we find the term kultura informacyjna (Koltay et al., 2010). If we translate the latter into English, it becomes information culture. However, this understanding is not identical with the concept that bears the same name, but is attributed to effective information management in corporate settings.

As outlined by Oliver (2008), the latter understanding of information culture is tied to the recognition and acceptance of societal and organizational requirements for managing information. It takes attitudes toward sharing information into consideration. It recognizes the importance of utilizing information and communication technologies and underlines trust in written documentation.

Having said this, it is apparent that—despite obvious differences—these latter features of information culture do not sound out of place when applied to information literacy in research settings, which follows basically the same preferences though in a different setting.

The cultural nature of information literacy is reinforced if we accept that literacy is a form of cultural knowledge which enables us to recognize and use language appropriate to different social situations (Campbell, 1990). Therefore, provided that information literacy is a way of functioning within complex communicative situations (Geisler et al., 2001), these situations are also cultural in their character. On the other hand, we may agree that a main constituent of IL is closely related to information seeking, the essence of which is finding texts that answer our information needs.

Yet, the connectedness of information literacy to culture does not end here. The disciplinary culture of researchers and information literacy can also be correlated. Their interface is provided by a personal information culture (PIC), defined as a system of knowledge and skills that may be used independently for the optimal satisfaction of information needs through the use of traditional and new information technologies (Gendina, 2008).
There are more—though different—contents in information literacy. The examination of fairly rapid changes of direction are metaphorically called turns to focus attention on a new way of thinking (Bawden & Robinson, 2012) in LIS that also provides a helpful context that gives additional insights into the nature of IL. Such moves may be called not only turns, but also new paradigms, new perspectives, or new viewpoints (Nolin, 2007).

There are a number of different classifications of these turns (Cronin, 2008; Nolin & Åström, 2010). However, we will concentrate only on a selection.

The most important turns that have characterized recent decades are the historical turn, the linguistic turn, the cognitive turn, the sociological turn, and the socio-cognitive paradigm.

We can say that the historical turn constitutes a search for the identity of LIS (Nolin, 2007). The linguistic turn can be attributed to discursive approaches, preceded by a turn in philosophy. It was followed by the cognitive turn, which brought with it a shift from a focus on linguistic acts to individual thought processes (Bawden & Robinson, 2012).

In other words, the cognitive turn focused on the cognition of information users and challenged the dominance of traditional approaches toward information retrieval (Cronin, 2008). This turn has been criticized by Nolin (2007) for alienating researchers from a sociological perspective, even though they would view cognitive dimensions as basically social.

As regards the sociological turn, we can say that LIS has long been receptive to sociological thinking, so it is probably misleading to speak of a sociological turn but could be named social turn instead (Cronin, 2008).

A central point of the socio-cognitive paradigm (also referred to as the domain analytic paradigm) is the claim that tools, concepts, meaning, information structures, information needs, and relevance criteria are shaped in discourse communities (Hjørland, 2002).

It recognizes that there is interplay between domain structures and individual knowledge, as well as an interaction between the individual and the social level (Hjørland & Albrechtsen, 1995).

This paradigm changes the focus of LIS from individuals and computers to the social, cultural, and scientific world. It also implies that the relevant cognitive structures are developed historically, culturally, and socially. One important implication of this paradigm is that the relevant cognitive structures are of a historical rather than of a physiological nature (Hjørland, 2002).
Robinson (2009) underlines the view that the socio-cognitive paradigm avoids the overtly systems approach, common in the early days of LIS, as well as the subjective and personal individual cognition approach. Indeed, Hjørland and Albrechtsen (1995) present this paradigm as an alternative to psychologizing or concentrating on IT issues.

The relationship between IL and these turns is relatively complex and we can approach this question from different directions. This complexity is exemplified by the viewpoint of Johnston and Webber (2005). When proposing information literacy as a soft applied discipline, they use Vannevar Bush’s vision of the technologically connected and enabled researcher, giving special attention to specialization.

The four approaches to information literacy, devised by Sundin (2008) and described in more detail in the chapter on shifting approaches to information literacy also illustrate its paradigms. If we recognize the validity of the socio-cognitive paradigm for LIS, the closest approach to IL is the communicative one. This approach is characterized by Sundin (2008, pp. 35–36) as follows:

> It challenges the portrayal of information seeking as an individual process. In contrast to the process approach, information seeking is here understood as social practices embedded in other social practices, which occur in institutional contexts. Among the issues that the communication approach foregrounds are the importance of interaction between users in information seeking, the relation between cognitive authority and source evaluation, and the significance of social navigation.

Last, but not least, we can affirm that if LIS focuses on selecting, organizing, storing, retrieving, disseminating, and using information, then information literacy represents a mixture of LIS and education as it also looks at teaching and learning (Bowler & Large, 2008).

The communication chain in information science is deeply influenced by computing (Bawden & Robinson, 2012), as are information literacy and Research 2.0. The question is whether ubiquitous computing and the increasing social dimension of networked media can bring in something that takes us beyond blogs, twitter feeds, and so forth, and “make possible something truly collaborative – something like the super-critical thinking that is generative of ideas, modes of thought, theories, and new practices” (Berry, 2011, p. 8).

If our previous context was metatheoretical, the next is based on practice, at least in its name and orientation. It is evidence-based practice (EBP), which has a number of connections to IL. Adams (2014) shows this by comparing two foundational texts of EBP. He found that the outcomes
described in the ACRL Standards provide a foundation for EBP and IL skills are highly valued by evidence-based practitioners.

As regards the evaluation of information quality, Adams asserts that EBP de-emphasizes expert opinion and the authority of the researcher, while librarians use the authority of the information creator as a marker of quality. This is true despite the fact that the ACRL Standards direct attention to the ability to “analyze the structure and logic of supporting arguments or methods.”

On the other hand, EBP works with information already vetted through peer review, so information creators can be judged as “authoritative” by most observers. Some of the information that academic librarians deal with are not amenable to the statistics-based evaluation that is the focus of critical appraisal in EBP.

Moreover, librarians’ use of authority as a primary marker of quality “may be an artefact of collection development policies that were created to squeeze the most value from a finite budget, and, for print formats, limited shelf space” (ACRL, 2000, p. 242).

When speaking about the relationship between IL and the researcher, we have to give attention to information style. As Johnston and Webber (2003) stress, IL is the adoption of appropriate information behavior. Consequently, it is not by accident that information style can play an important role in it.

According to Steinerová (2010), information style is based on the analysis of an individual’s information seeking preferences and perceptions, and the characteristics of their use of electronic resources.

Two main styles can be identified: the pragmatic and the analytic. The former is dominant and is characterized by preferences for simple access to information, simple organization of knowledge, low cost, and fast access to electronic resources. Its representatives would not read extensive texts because they are experiential learners.

Those who represent the analytic style show deeper intellectual information processing. Reliability and verification of information are important for them. They use multidisciplinary terminology and assess information by its relevance, having experience in judging it. They use complex queries in contrast to intuitive, simple ones. Organization of information is integrative, based on expert knowledge and experience. The analytic style requires intellectual processing and the presence of doubts and interpretation is stressed instead of navigation.

In our opinion, the pragmatic style is compatible with amateurism, thus has a place in public library environments, while the analytic style is the ideal for academic users and literacies geared toward their needs should
show preferences for this information style. If not, we are taking the risk that the already existing lack of critical thinking within academia will be aggravated (Head & Eisenberg, 2009).

By emphasizing being critical, information literacy and related literacies give attention to cognitive authority, which has two levels. At an operational level, cognitive authority is the extent to which users think that they can trust the information.

On a more general level, cognitive authority refers to influences that a user would recognize as proper because the given piece of information is thought to be credible and worthy of belief (Rieh, 2002).

The idea of cognitive authority can be traced back to Second-Hand Knowledge, a seminal work of Patrick Wilson who reminds us that a large portion of what individuals know about the world comes from other people. Following the thoughts of Wilson, Rieh (2002, p. 146) defines cognitive authority as “influences that a user would recognize as proper because the information therein is thought to be credible and worthy of belief.”

Cognitive authority comes in two forms: a level of trust can be granted in the information communicated by a person or contained in a particular source. Obviously we know that researchers use recorded information, thus they rely on facts that are contained in information sources. On the other hand—as we have already pointed out above—it is known that informal communication plays a significant role in their information acquisition.

In any case, motivation and cognitive ability play a significant role in guiding information assessment and decision-making, and are a main component in building up the skills needed to determine the quality or credibility of information. This is especially true for digital literacy (Metzger, 2007), but the communication approach to information literacy also stresses the relation between cognitive authority and source evaluation (Sundin, 2008). It is also a constituent of information horizons that map information sources (Steinerová, 2010). The nature of digital literacy will be discussed on in the next section, on page 85.

**LITERACIES BEYOND INFORMATION LITERACY**

We cannot complain that there are not enough types of literacy.

Snavely and Cooper (1997) provided 34 literacy terms. Their examples include:

- agricultural literacy;
- cinematic literacy;
• dance literacy;
• geographic literacy;
• legal literacy;
• workplace literacy.

In his widely cited review, Bawden (2001) enumerates six extensively used terms related to information literacy which are often used synonymously with each other.
• computer literacy: synonyms—IT literacy, information technology literacy, and electronic literacy;
• electronic information literacy;
• library literacy;
• media literacy;
• network literacy: synonyms—Internet literacy, hyper-literacy;
• digital literacy (with its synonym—digital information literacy).

Meanwhile, the conceptual universe of information literacy is expanding unstoppably and uncontrollably. Visioning the future, Ridley devised post-literacy, defining it as “the state in which reading and writing are no longer a dominant means of communication” (Ridley, 2012), while Kress is talking about visual objects instead of letters and screens instead of books (Kress, 2003).

We have also had a colorful transliteracy approach since 2005 (which was originally coined to support the cross-sectional approach of communication platforms and later developed into the “3 T”-paradigm: teaching, technology, and transliteracy). As a “unified construct that supports the acquisition, production, and sharing of knowledge in collaborative online communities,” metaliteracy was born to promote “critical thinking and collaboration in a digital age, providing a comprehensive framework to effectively participate in social media and online communities.” 2 (See also the section on overarching literacies.)

It is also very common to identify new information literacies in various contexts, such as, for example, writing studies (Shepherd & Goggin, 2012). Nevertheless, the common nature of every activity related to information is invariant: visual representation as information input, processing in the brain, and objectivation (exformation) as information output.

Therefore, the changing nature and complexity of information literacy is not situated within a cognitive or technological framework, but in the field of transformational social practice, embedded into the digitally

2Metaliteracy: http://metaliteracy.org/about/.
mediated cultural environment. This also means that the architectures, services, solutions, tools, and gadgets of the universe of future information and communication technologies are important. However, the changing patterns and structure of everyday life are decisive. Putting it the other way around: new literacies are “required for successful participation in an increasingly technologically mediated society” (Forte et al., 2014). This is the reason why the term *transformational literacies* was born in order to prepare users for life, and to help them see connections between working hard as readers and writers (Berger et al., 2014).

Andrea Forte proposed a new framework which highlights the “critical dimensions” of information literacy, while simultaneously indicating the main directions of change on two axes as shown in Table 1.

It is almost impossible to compose a full, overall, perfect classification system of every form of literacy because of the dynamic nature of the field. The emerging literacies become new, the new literacies become old, while the old literacies are continuously augmented with new features and relevancies.

New sets of literacies can be brought into the discourse in order to assist in understanding its disruptive nature. These literacies are **newborn, transforming, hybrid, and hyperpeople literacies**. We hope that this enriched conceptual framework will influence not only literacy debates, but also raise the awareness and stimulate the design of new intellectual, educative and work environments, refreshing pedagogy or training practices.

The reason behind the birth of brand new literacy types is not only the cumulative relocation of the basic forms of activity and transaction into the digital ecosystem but also the overflow of closed, professional knowledge

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Dynamics of information literacy development</th>
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<tr>
<td><strong>Social</strong></td>
<td><strong>Technological</strong></td>
</tr>
<tr>
<td><strong>Consumption</strong></td>
<td>Educating people to find and use information well</td>
</tr>
<tr>
<td><strong>Approach to</strong></td>
<td><strong>Transforming practice</strong></td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>Educating people to create and contribute information sources</td>
</tr>
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Forte et al. (2014); used by permission.
sets, creating casual, everyday, trivial versions and generating a kind of wave of “literacy emancipation.”

The pioneering field of financial literacy has evolved into the ability to make informed decisions about how to use and—later—how to manage our money and financial transactions online, including saving, banking, budgeting, smart shopping tips, understanding types of loans and credit and how to manage debt, investing and financial planning, choosing suitable mobile phone plans, avoiding scams and rip-offs, and explains the basics about insurance and superannuation.

Healey (2010).

Legal literacy was born as an ordinary digital literacy of lawyers and students of law schools (Margolis & Murray, 2012), while psycho-literacy was introduced, especially to students, as the general knowledge of basic terms and concepts within the psychological community (Boneau, 1990).

A few years later, the concept was extended to legally and psychologically literate citizens (Dunn, 2011; Mair, Taylor & Hulme, 2013). Currently, it is more than important for every “netizen” to identify, know, and understand the legally sensitive fields found in typical online activity forms, and the psychologically sensitive found in person-to-person online communication.

The explosion of health information for patients and health practitioners as well as other digital health tools and applications (Behrman, 2012) prompted the change from health awareness to health literacy. This marked a step up “from just looking at health information, and moves toward a model that involves behavior changes and digital interaction” with and between patients (Fink, 2014).

The junior concept of futures literacy was coined primarily to enhance the skill-set of policy-makers (Miller, 2011). However, the anticipatory systems and models, including the techniques of scenario making, have meant that everyone is able to get better decisions, and are available for civil organizations, local communities, interest groups, and even individuals.

The second cluster of emerging literacies consists of significantly improved versions of earlier literacy forms, following the inherent changes within the given domains, while reflecting the extended playground of activity forms as part of the “gradation” from the receptive to a receptive and productive nature.

Visual literacy (or visuacy), as a conceptual approach to graphic problem-solving (Wilde & Wilde, 1991), has been transformed into a more complex form using comic books, graphic novels, anime, cartoons,
and more to develop comprehension and thinking skills (Frey & Fisher, 2008). Following the revolution in everyday information architecture and infographics, graphicacy (Aldrich & Sheppard, 2000) is increasingly becoming “infographicacy,” and a part of broader design literacy (Heller, 2014).

**Game literacy** entered the vocabulary of academics and teachers to take “seriously the serious play of young people … analysing games and the world of games as text” (Beavis et al., 2012). A few years later, serious games became integral parts of learning environments, while gamification, the use of game thinking, and game mechanics in non-game contexts arose and spread in company and big organizational environments (Deterding et al., 2011). This idea led to the emergence of gamification literacy, that is, gamificacy.

Social media stimulate participation in public and semi-public spaces accompanied by a new ability: participatory (participation) literacy. Following the shift in emphasis from discussions to real-world interventions and from interaction to decision-making competency and responsible execution, the operative part of social actions established a new literacy set: operacy. This includes the abilities needed for agenda setting, strategic planning, managing conflicts, or sharing tasks.

In a wider sense, we can speak about the ability to create public content. This leads to content creacy. As this book focuses on research, emphasis has to be put on scientific literacy (on page 89) which will be addressed later. Similarly, there will be a detailed explanation of the nature and importance of data literacy.

Data and game literacies can easily form hybrids with other literacies, since data can be found everywhere and there are almost no limits to gamification in these environments. The combination of health literacy and numeracy is important “to understand, evaluate, and use numbers … to make informed health care choices” (French, 2014). There are many good examples illustrating how gamification could influence clinicians’ practice (Miliard, 2014) and patients’ behavior (King et al., 2013).

Scientific infographics has also become popular, since data visualizations can assist in the understanding of the conceptual and the practical and communicate scientific results (Jackson, 2014). Furthermore, we also have a long record of combining scientific learning with games (Hilton & Honey, 2011).

Disciplinary differences in information literacy practices also appear. While a substantial part of any IL program that is directed toward researchers must be the same, irrespective of whether they work in the natural sciences, the social sciences, or the humanities, the specificity of a given field has to be taken into consideration. It is enough to mention that work in
the humanities is more closely tied to documents than the activities of any other researchers.

Being connected is reflected in the information literacy syllabus for humanities researchers designed by East (2005). This program is divided into two parts: the first addresses general skills, while the second is about specific formats.

The starting point to identify general skills is thinking about how information is disseminated in the given discipline and where this information is located. In other words, those working in the humanities have to understand how information is disseminated in their discipline. Accordingly, researchers should be able to identify the physical or virtual repositories which contain significant collections of relevant materials.

The next element of the syllabus directs attention to the fact that the approach to identifying appropriate print and electronic bibliographic tools has changed in the time that has elapsed since the publication of East’s paper.

In fact practically a decade has gone by, which has brought a reliance on search engines, in particular on Google. This primacy also characterizes Google Scholar to an extent, though it can also be regarded as a kind of bibliographic tool (Asher, Duke, & Wilson, 2013).

Not to forget that the literature on the information habits of humanists has traditionally stressed that scholars have made only limited use of major abstracting and indexing journals (East, 2005).

The statements made in 2005 about searching databases effectively are, mutatis mutandis, still valid. If there were disparities among researchers in their searching abilities, they did not disappear, even though their nature may have changed. This reminds us of the situation described by Herman and Nicholas (2010), according to whom present-day information seekers consistently demonstrate characteristic patterns of unproductive information behavior. (See the section on disintermediation and re-intermediation).

Last, but not least, we can add that keeping up to date in their field and establishing a network of contacts remains of perpetual value and forms a continuing practice for researchers.

There are a number of other literacies we have to take into consideration. Some have been mentioned in the section, entitled “How many literacies are there?” The literacies that appear below are those that are apparently most closely connected with research activities. These are scientific literacy and academic literacy.

Scientific literacy comprises the methods, approaches, attitudes, and skills related to thinking scientifically and doing research. We can also add to this
that anyone who has acquired scientific literacy is able to understand articles about research in the popular press and engage in social conversation about the validity of their conclusions (NAS, 1996). This implies that everyone should be scientifically literate, even if only a small number of graduate students become researchers.

*Academic literacy* is more closely associated with formal learning, especially in higher education. Norgaard (2003) characterizes literacy as a culturally situated phenomenon based on the way that communities construct meaning and belonging. This is especially true for academic literacy, which involves the comprehension of the entire system of thinking, values, and information flows of academia. All this is based on a cultural identity among academics in which professional language and literature play a key role. In this system, information has a grammatical dimension that information literate academics must master (Elmborg, 2006).

In higher education, literacy has always included knowledge and skills that go beyond the ability to read and write. It encompasses the skills needed for identifying appropriate materials for study, while presupposing discipline-specific reading and writing skills in order to be critical and articulate.

Having said this, we have to acknowledge that the journey toward today’s literacy is complicated and crosses a shifting terrain where technologies and associated practices are constantly changing. Accounts of literacy in online environments have to take into consideration that the acts of communicating and interpreting are not neutral and rely more on socially constructed relationships than on technological affordances.

It is relatively easy to see that both literacies mentioned above are pre-requisites of becoming a researcher and fulfilling the researcher’s role. It seems to be clear as well that these two literacies complement one another and, at the same time, are strongly dependent on information literacy, at least in research environments.

The essence of academic literacy is the ability to “read, interpret, and produce information valued in academia according to beliefs about how research should be done” (Elmborg, 2006, p. 196).

As mentioned above, these communities are different from the amateur ones on the grounds of the significance of their distinguished credentials and authorship. Friesen (2010) indicates that in commercial social networks, there is a lack of critical comparing and contrasting of different views.

In a broader sense, academic literacy should also include the ability to discern predatory open access journals that seek to exploit the author-pays open access model to gain profit, without living up to the standards of
scholarly publishing. To achieve this is much easier for experienced researchers, who usually know the best and most prestigious journals in their fields. Younger researchers who are new to publishing journal papers face a relatively difficult situation as they do not usually have this advantage.

There are some indications to look out for that demonstrate the low quality of these journals. For example, behind them there are no well-established and reliable publishers or publishers associated with universities or learned societies. They apparently have editorial boards, but these often do not play any effective role in the decision to publish particular papers. Fake journals may have no peer review at all, or do not do it properly, as suggested by the suspiciously short deadlines for peer-reviewing manuscripts (Mehrpour & Khajavi, 2014).

*Media literacy* is often mentioned alongside information literacy. Potter (2004) defines media literacy as “the set of perspectives from which we expose ourselves to the media and interpret the meaning of the messages we encounter.” Similar to information literacy, media literacy accentuates critical evaluation. It acknowledges both the reception and production of media (EC, 2009) and includes the interpretation of all types of complex, mediated symbolic texts made available by “traditional” or electronic (digital) means (Livingstone, 2004). This demonstrates the relevance of media literacy for a wide array of media, including research data. We can also include the convergence among literacies, which is caused by the convergence of different forms of media and ICT (Livingstone et al., 2008).

Making use of the Web of Science database, Lee and So (2014) have explored the relationship between media literacy and information literacy. They looked for occurrences of the key words “information literacy” and “media literacy” from 1956 to 2012. Their findings show that the two fields have different authors, affiliations, and publication venues.

The authors’ academic origin, scope, and social concerns are also different. Information literacy has a closer tie to LIS, but the two fields adopt different analytical approaches. Lee and So state that media literacy cannot be regarded to be a subset of information literacy, even though the two fields share the same goals.

Nonetheless, the arguments of Badke (2009) are valid, as he warned about the danger of living in silos, emphasizing that separation is a hurdle that these literacies must overcome so that they can play a foundational role in today’s education. Koltay (2011) also comments that media literacy has to find its essential role in education as one aspect of some kind of multiple or multimodal literacy.
It is not just the quantity of media exposure that justifies the importance of media literacy. All of us have experienced the heavy presence and influence of the different media that more recently has included the Internet. The vital role of information in the development of democracy, cultural participation, and active citizenship also justifies our interest and these features draw media literacy near to information literacy.

In the contemporary media environment, users and their interests are represented in mediated spaces, which also serve as an environment to activate engagement with others (Jarrett, 2008). Media literacy also takes into account that media is constructed and constructs reality. Therefore it consists of the following competencies:

- A media literate person – and everyone should have the opportunity to become one – can decode, evaluate, analyze and produce both print and electronic media.
- The fundamental objective of media literacy is critical autonomy relationship to all media. Emphases in media literacy training range widely, including informed citizenship, aesthetic appreciation and expression, social advocacy, self-esteem, and consumer competence (Aufderheide, 1992).

The definition adopted by several organizations in the European Union also stresses the critical aspect as well as acknowledging both the reception and production of media.

- Media literacy is generally defined as the ability to access the media, to understand and to critically evaluate different aspects of the media and media contents and to create communications in a variety of contexts (EP, 2007).

In accordance with this definition, the various levels of media literacy include:

- feeling comfortable with all existing media from newspapers to virtual communities; actively using media through, inter alia, interactive television, use of Internet search engines or participation in virtual communities; and better exploiting the potential of media for entertainment, access to culture, intercultural dialog, learning and daily-life applications (for instance, through libraries, podcasts);
- having a critical approach to media as regards both quality and accuracy of content (e.g., being able to assess information, dealing with advertising on various media, using search engines intelligently);
- using media creatively, as the evolution of media technologies and the increasing presence of the Internet as a distribution channel allow an
ever growing number of Europeans to create and disseminate images, information, and content;

- understanding the economy of media and the difference between pluralism and media ownership;
- being aware of copyright issues, which are essential for a “culture of legality,” especially for the younger generations in their double capacity of being consumers and producers of content (EP, 2007).

For IL authors, their main information objects are peer-reviewed and evaluated publications, such as academic books and journals. In contrast, media literacy focuses on mass media such as newspapers and television that are typified by having less source validation because of the rapid production that characterizes them (Lau, 2013).

Let us add that there is news literacy, which aims to offer tools for the development of the critical thinking skills necessary to evaluate the veracity of what we receive through 24-h news channels, social media, and other online sources of information (Dowling, 2013).

As said above, media literacy and information literacy partially overlap and complement each other, as both basically aim to foster the same skills (Lau, 2013). Taking this into account, information literacy and media literacy have recently been coupled with each other under the umbrella concept of media and information literacy.

For instance, the World Summit on the Information Society advocated the promotion of information and media literacy, regarding them as indispensable individual skills for people in the increasing information flow (WSIS, 2013).

The definition of media and information literacy is basically identical to the definition of information literacy. It “consists of the knowledge, the attitudes, and the sum of the skills needed to know when and what information is needed; where and how to obtain that information; how to evaluate it critically and organise it once it is found; and how to use it in an ethical way” (IFLA, 2011).

The Moscow Declaration on Media and Information Literacy adds that media and information literate individuals “can use diverse media, information sources, and channels in their private, professional, and public lives” (IFLA, 2012).

We have to take into consideration the already mentioned convergence among literacies caused by the convergence between different forms of media and ICTs (Livingstone et al., 2008). This move is not surprising, and we may agree with Carbo (2013), who asserts that information literacy and
other related literacies are undergoing a transformation which may result in the emergence of a new paradigm of its own. She adds that—instead of looking at the many differences among the various perspectives—this new paradigm, with its broader perspective integrating the many different forms of literacy, should be explored in much more depth.

Referring to the explosion in user-generated media which will be fully felt in the workplace, Davies, Fidler, and Gorbis (2011) speak about new-media literacy. They define it as the ability to critically assess and develop content that uses new-media forms, including videos, blogs, and podcasts. New-media literacy also means leveraging these media for persuasive communication.

Data literacy pertains to the cluster of emerging literacies mentioned above. We find it at the intersection between scholarly communication and information literacy (ACRL, 2013). Data is no longer limited to quantitative results drawn from experiments or surveys, so humanities and social science researchers represent a new constituency for data literacy education (ACRL, 2013). This expanding view of what we mean by data, coupled with the growing importance of research data mentioned above, has brought with it the growth in the need for data literacy.

The concept of data literacy is not entirely new. However, new and emerging roles have influenced its nature to a substantial extent. The blurring of boundaries between information and data are also having a determining effect. In fact, they never have been rigid, as information literacy has always been interested in the proper understanding and use of data that is converted into information (Schneider, 2013).

Data literacy enables individuals to access, interpret, critically assess, manage, handle, and ethically use data. Managing, as it appears in this definition, comprises preservation and curation (Calzada Prado & Marzal, 2013).

Mandinach and Gummer (2013, p. 30) define data literacy as “the ability to understand and use data effectively to inform decisions.” They add that it is a specific skill set and knowledge base that enables us to transform data into information and ultimately into actionable knowledge. Data literacy skills include knowing how to identify, collect, organize, analyze, summarize, and prioritize data. The last two skills are especially worthy of attention as they are the skills that do not appear in other lists. Developing hypotheses, identifying problems, interpreting the data, and determining, planning, implementing, as well as monitoring courses of action are also necessary skills that are among the requirements for tailoring data literacy to its specific uses.
This set of definitions reflects a systemic cultural change in the importance, purposes, language, skills, and processes of data management (Varvel & Shen, 2013). It is also congruent with the opinion of Qin and D’Ignazio, according to whom science data literacy—though named differently—emphasizes the ability to understand, use, and manage science data.

These definitions also subsume the reasoning of the Association of College and Research Libraries (2013), which voted for the term data literacy. Their approach focuses on understanding how to find and evaluate data, emphasizes the given version of the data set and the person responsible for it, and does not neglect the questions of citing and ethical use of data. According to the ACRL, data literacy is a literacy conceived for those who will use the data and will need educating about how to understand and interpret them.

This literacy concentrates on ownership and rights issues, and cuts across disciplinary boundaries and the traditional structures of academic library organizations. Such an approach to data literacy shows similarities with media literacy by the use and reuse of content in ways not imagined by its original creator.

There are a number of reasons why we need data literacy. However, perhaps the most important factor is that we are witnessing a widespread belief that the existence and access to research data, in particular to big data, offers a higher form of intelligence and knowledge.

There is an aura of truth, objectivity, and accuracy around it, as well. Big data is seen as a solution to many burning questions, which may raise suspicion. On the other hand, it is often regarded as a tool that threatens privacy and decreases civil freedoms, ushering in increased state and corporate control. The shifts to be expected of big data are probably more subtle than these, even though we cannot see this clearly among our current hopes and fears (Boyd & Crawford, 2012).

This leads to the conclusion that one of the most important goals of data literacy education should be to foster the critical thinking that will keep us away from the pitfalls of being overly optimistic or unduly pessimistic, or behaving in an excessively critical or uncritical way.

Data literacy should take into consideration the framework of future work skills and abilities outlined by Davies et al. (2011). The first, data-based reasoning, we have already mentioned.

The need for being critical is no different from other literacies, so it occupies a special place among the general features of data literacy. It includes placing emphasis on the given version of the data set and identifying the person responsible for it (ACRL, 2013).
On the other hand, there are additional features, such as understanding what data means, including how to read graphs and charts appropriately, drawing correct conclusions from data, and recognizing when data is being used in misleading or inappropriate ways, that are also constituent of data literacy.

The main fields where the core competencies of data literacy can be used are as follows:

- databases and data formats;
- discovery and acquisition of data;
- data management and organization (including the life cycle of data and standard operating procedures for data management and documentation);
- data conversion and interoperability (dealing with the risks and potential loss or corruption of information caused by changing data formats);
- quality assurance;
- metadata;
- data curation and reuse;
- cultures of practice (including disciplinary values and norms and data standards);
- data preservation;
- data analysis;
- data visualization;
- ethics, including citation of data (Carlson et al., 2011).

Data literate people (users, researchers, and librarians) have to know how to select and synthesize data and combine it with other information sources and prior knowledge. They have to recognize source data value, types, and formats; determine when data is needed; and access data sources appropriate to the information needed.

Data literacy seems akin to information literacy as planning, organizing, and assessing ourselves throughout the process are vital and the ability of presenting quantitative information in different and appropriate forms also has to be emphasized (Calzada Prado & Marzal, 2013).

The above sequence of steps is closely associated with the well-known and widely accepted definition of information literacy, according to which information literate people are able to recognize when information is needed. They are also able to identify, locate, evaluate, and use information to solve a particular problem (ALA, 1989).

As said, data management in general and the quality of data in particular for data citation are of significance for data literacy. Tracing back data provenance and its justification (Buckland, 2011) are components of data literacy through data quality. The former includes the tracking of all contexts and
transformations which the data has gone through and is of key importance to verifying the authenticity and reliability of data files (Ramírez, 2011).

Data literacy should also include answers to the question of openness, primarily open data as advocated by a number of researchers in order to make science more accountable (Stuart, 2011).

From other related fields, where data literacy competencies can be potentially used, the following must be mentioned:

• data analysis;
• data visualization;
• dealing with the risks and potential loss or corruption of information (Carlson et al., 2011).

Calzada Prado and Marzal (2013) emphasize the importance of knowing how to select and synthesize data and combine them with other information sources and prior knowledge. They also enumerate the following abilities:

• to identify the context in which data are produced and reused (data lifecycle);
• to recognize source data value, types, and formats;
• to determine when data are needed;
• to access data sources appropriate to the information needed;
• to critically assess data and their sources;
• to determine and use suitable research methods;
• to handle and analyze data;
• to present quantitative information (specific data, tables, graphs, in reports and similar);
• to apply results to learning, decision-making, or problem-solving;
• to plan, organize, and self-assess throughout the process.

It is not by accident that context is mentioned in the above list in the first place. Context is utterly important. Dissociation of data from its context and the loss of context make reuse difficult, or impossible (Schneider, 2013).

From the content of a series of instructional sessions on socio-economic data described by Wong (2010), we can single out three aspects. The first aspect is exploring data evaluation and use. The second one is guiding students in understanding data-collection methods and dissemination channels. The third aspect is introducing students to different information needs that are fulfilled by data.

As service providers, data librarians should be acquainted with quantitative research methods which enable them to process and analyze research data. To be able to provide support for researchers, they have to possess an
extensive understanding of scientific data sources which will enable them to recommend comprehensive and reliable data sources (Si et al., 2013).

As we have already underlined, and as Lee (2013) also emphasizes, many novel and compound literacy concepts have appeared to face the challenges brought about by the changes in the new social and technological environments. These literacies are also often called *overarching literacies* or *twenty-first century competencies*.

All the literacies that have been discussed in the previous sections fit well into the framework of metaliteracy, which is undoubtedly an overarching concept as it provides the foundation for media literacy, digital literacy, and other literacies, and fosters both critical thinking and participation via social media. Metaliteracy is a self-referential and comprehensive framework that informs these other literacy types. It provides the foundation for media literacy, digital literacy, and other literacies, and emphasizes content.

According to Mackey and Jacobson (2011, p. 62):

*Metaliteracy promotes critical thinking and collaboration in a digital age, providing a comprehensive framework to effectively participate in social media and online communities. It is a unified construct that supports the acquisition, production, and sharing of knowledge in collaborative online communities.*

They also add the following:

*Metaliteracy expands the scope of information literacy as more than a set of discrete skills, challenging us to rethink information literacy as active knowledge production and distribution in collaborative online communities.*

(p. 64)

Witek and Grettano (2014) are of the opinion that metaliteracy has acquired an even greater significance for reframing information literacy in today’s information environment. They assume that a fully realized theory of information literacy, the foundation of which is metaliteracy, includes a meta-awareness of what we do with information and why.

The next “overarching” literacy is transliteracy that comprises the ability to read, write, and interact across a range of platforms, tools, and media. It intends to be concerned with understanding and explaining the meaning of being literate in the twenty-first century. While it is an overarching concept, it is not meant to replace any of the format-specific literacies. It attempts to understand the relationship among them instead.

Transliteracy maps meaning across different media, in the interaction among different literacies. It is not concerned with developing particular literacies about particular media. It analyzes the social uses of technology by
focusing on the relationship between people and technology, most specifically social networking. However, it is not tied to any particular technology.

Due to this holistic nature of transliteracy, it is challenging to define what specific skills are necessary to engage with it. Attention to transliteracy is especially worthwhile as, by exploring the participatory nature of new means of communicating, it intends to break down the barriers between academia and the wider community (Ipri, 2010).

The object of both information literacy and digital literacy is invariably the same, that is, information. However, information literacy mobilizes the abilities and skills related to finding, retrieving, analyzing, and using information. In contrast, digital literacy not only accentuates its creation but also emphasizes the use of digital technology (Qin & D’Ignazio, 2010).

The concept of digital literacy in its present understanding was introduced by Gilster (1997). However, he was not the first to use this expression. It had been applied in the 1990s to denote the ability to read and comprehend hypertext (Bawden, 2001).

Gilster explained digital literacy as an ability to understand and to use information from a variety of digital sources without concern for the different “competence lists,” often criticized as being restrictive.

The four core competencies of digital literacy are:

- Internet searching;
- hypertext navigation;
- knowledge assembly;
- content evaluation (Bawden, 2008).

Martin’s definition of digital literacy emphasizes both its wide meaning and the role of media.

> Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process


A distinctive feature of digital literacy is expressed by Bawden (2008, p. 26):

> Digital literacy touches on and includes many things that it does not claim to own. It encompasses the presentation of information, without subsuming creative writing and visualization. It encompasses the evaluation of information, without claiming systematic reviewing and meta-analysis as its own. It includes organization of information but lays no claim to the construction and operation of terminologies, taxonomies and thesauri.
Digital literacy does not lower the standing of traditional literacies. It is much more inseparable from and fundamental to reading, writing, and arithmetic (Murray & Pérez, 2014). Accordingly, it has to be built both on traditional literacy skills and an orientation to the understanding of twenty-first century socio-technical systems (Meyers, Erickson, & Small, 2013).

In digital literacy, traditional tools (often known from IL) continue to play an important role, while it reflects that ordinary people have become not only receivers but also senders of messages (Bawden, 2001).

In their draft report, the Digital Literacy Task Force of the American Library Association defined digital literacy as, “the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills” (ALA, 2012, p. 1). They add that digitally literate persons possess technical and cognitive skills that are needed to find, understand, evaluate, create, and communicate digital information in a wide variety of formats.

These people are able to use diverse technologies appropriately and effectively to retrieve information, interpret results, and judge the quality of that information. As regards researchers, they use their skills and the appropriate technology to communicate and collaborate with peers, colleagues, and occasionally the general public.

Digital literacy includes the ability to read and interpret media and use information in multiple formats from a wide range of sources when presented via computers. It also enables the performance of tasks effectively in a digital environment (Wilson et al., 2011).

We should also mention that data literacy and transliteracy are grouped in a White Paper, Intersections of scholarly communication and information literacy: Creating strategic collaborations for a changing academic environment under the rubric of digital literacies (ACRL, 2013).

The second perspective on digital literacies, as outlined by Meyers, Erickson, and Small (2013)—emphasizes the application of abstract mental models to activities involving digital content. These models address the processing by individuals of information from a cognitive viewpoint.

The third perspective sees digital literacy as engagement in a set of practices involving digital tools and media that are embedded in socially constructed and situated contexts or activities. Instead of providing a list of discrete skills, this perspective operates within the general capabilities that
individuals have for living, learning, and working in a digital society. These capabilities recognize and reflect on the constant changes in technology and the behavior and characteristics of digital citizens.

The notion that digital literacy is an evolving construct is both its strength and weakness: while it privileges a wide range of expertise and a nimble conception of the value of digital literacy in society, it is notoriously difficult to assess, and does not mesh well with the existing formal systems of certification or endorsement. This perspective sees participation as the key to developing digital literacies.

Digital literacy, then, could be seen as the study of written or symbolic representation that is mediated by new technology. Its prime concern would be the production and consumption of the verbal and symbolic aspects of screen-based texts—this would be its initial point of departure from print literacy. Furthermore, the specific affordances of digital literacy could be conceptualized as a product of the technological means of its production and consumption. This is not to deny the complex and often very visual nature of many digital texts (Merchant, 2007).

We classified many of the literacies discussed above as overarching. While in the case of metaliteracy and transliteracy there is less doubt about this quality, it is especially intriguing to examine digital literacy. Martin (2006) stated that digital literacy was an integrating but not overarching concept. Owusu-Ansah (2003) identified the attempts to define information literacy as all-inclusive as the main discernable fault.

Nevertheless, there are a number of literacies that could compete to be named as overarching. Beyond the literacies portrayed in this section, information literacy could be a successful candidate. SCONUL, for example, defines information literacy as “an umbrella term which encompasses concepts such as digital, visual and media literacies, academic literacy, information handling, information skills, data curation, and data management” (SCONUL, 2011).

Let us not forget that it is of little importance what we call the various literacies of the information age and how we define them (Bawden, 2001). As Hunt (2004) explains, there may be no agreement on the precise definition of information literacy. Nonetheless, most people use the term information literacy rather than library instruction or information fluency. However, if we do not use the same language, it will be difficult to convince our stakeholders about the importance of information literacy education. In the case of data literacy, we may experience the same.
THE RELATIONSHIP OF INFORMATION LITERACY TO INFORMATION OVERLOAD AND PERSONAL INFORMATION MANAGEMENT

It is likely that our previous argument has shown in a convincing manner that it is often difficult to name primary and secondary questions and fields when speaking about issues related to literacies, and especially information literacy. Notwithstanding this, many readers may judge the following problems to be more loosely related to our main argument. On the other hand, these “borderline” fields can easily become mainstream issues within a short period of time. In fact, while they are fundamentally important in their own contexts, they may be perceived to be of secondary importance to a certain (relative) extent in the information literacy context.

Even though we did not do so in the case of information literacy, it seems expedient to conceive of information overload (IO) by looking at what we understand as information. Buckland (1991) differentiates between three principal uses:

- **information-as-process**, that is, the act of informing;
- **information-as-knowledge**, that is, knowledge communicated concerning some particular fact, subject, or event;
- **information-as-thing**, that is, used attributively for objects, such as data and documents, which are regarded as being informative.

IO is related both to information-as-thing, that is recorded information, or—in other words—objective packages of cognitive content in a certain form (Kari, 2007) is important source of IO if it is available in abundance.

IO can also be defined as an impediment to efficiently using information due to the amount of relevant and potentially useful information available (Bawden & Robinson, 2009). The information cycle of personal documents is managed in an individual’s own collection, that is, informal, diverse, and expanding memory collections created or acquired and accumulated by individuals in the course of their personal lives, and belonging to them rather than to their institutions or other places of work (Williams, Leighton John, & Rowland, 2009).

We have to add here that IO often remains unrecognized (Badke, 2010) and its very existence is questioned by some authors. For example, Tidline (1999) is of the opinion that the concept functions as a modern-day myth.

However, if we accept that in fact it does exist, it is necessary to differentiate between the macro- and the micro-level of IO. The first is related to the limits of physical storage and processing capacities that present an
obstacle to information access. IO at the micro-level is essentially a failure to filter information (Davis, 2011).

Let us add that our information environment is characterized not only by greater amounts of information available in a greater variety of formats and types but also by delivery through a limited number of interfaces (Bawden & Robinson, 2009).

Besides the quantity, a substantial part of the information that we consume and have to manage is becoming more and more volatile (Davis, 2012). These factors contribute to a growing complexity, which materializes in diverse and abundant information choices in almost all fields (Morville, 2005), and is often coupled with people’s general inefficiency in performing a given task (Davis, 2012). Presupposing inefficiency is built on the assumption that a person can only digest a certain amount of information in any given time (Ji, Ha, & Sypher, 2014).

Complaints about IO itself are by no means new. A selection of the examples, presented by Bawden and Robinson (2009), shows this in the historical development of IO clearly.

Complaints about the difficulty of keeping up with the amount of information available began early. Nonetheless, information, contained in the printed book, the scholarly journal, and the computer have often been named as the sources of IO.

IO was generally accepted as a problem in the late 1950s and early 1960s. The exponential growth in the number of publications, particularly in science, technology, and medicine, was considered to be the cause. By the 1990s, references to IO began to appear in the business world as well.

IO has been heavily influenced by recent technological and cultural changes (Rapple, 2011). First of all, social media (often called new media) have had a significant effect on it. The fact that most Web 2.0 users express themselves in mediated spaces instead of communicating face to face (Jarrett, 2008) causes IO.

The uncontrolled nature of this communication, the ease of producing information, and the expectation of constant novelty require the rapid updating and posting of new material. This is aggravated by the lack of incentives to remove our production from the net (Brown, 2010).

As said above, the concept of IO involves the notion of excess. However, excess in itself is not a sufficient condition for being overloaded. Overload can be defined in comparison to some norms, which regulate what is an appropriate amount of information and which pieces of information are undesirable (Himma, 2007).
As IO is mainly a social condition propagated by people, it can be combated by offering appropriate education that focuses on critical thinking. The absence of such education and the lack of adequate information filters or the failure to apply them appropriately results in IO (Davis, 2011).

IO can rightly be called pollution. More importantly, however, it is useful to know that we can learn to work around it, instead of treating it as something that must be controlled and regulated (Springer, 2009).

In other words, the wealth of information becomes noise if one cannot make sense of it (Morville, 2005). Indeed, we receive more and more messages that are detached from all contexts, that is, are completely meaningless to us.

In essence, IL is about reconstructing this lost sense and context (Tuominen, 2007). This is why we can affirm that being information literate enables us to recapture “the control lost in the overload situation” (Bawden, Holtham, & Courtney, 1999, p. 253).

IO is the most widely recognized “pathology of information,” that is, an example of seemingly strange behaviors that we can observe, when individuals face difficulties in managing information, particularly when large amounts of diverse information are available.

Information anxiety is one of these pathologies, and is usually a condition of stress caused by the inability to access, understand, or make use of necessary information. There are infobesity and information withdrawal as well (Bawden & Robinson, 2009).

When describing another pathology, information malnutrition, Herman and Nicholas (2010, p. 246) state:

Ironically enough, the root of the ‘information malnutrition’ problem seems to be the very act of switching the information tap on to everyone, which all too often amounts to the removal of the information professional from the information equation.

We find a characterization of the problem a few pages later:

It is hardly surprising to find, then, that while people do indeed effortlessly acquire vast amounts of information, all too often none, or at most very little of it, aptly meets their needs. In fact, much of it amounts to the information equivalent of fast food: easily obtainable, flattering to the undiscerning palate, but of little actual value at its best, and harmful at its worst. Regrettably, though perhaps not unexpectedly, considering what we know of fast food consumption, people are satisfied enough with their information supply, never realising, or at least comfortably ignoring that they should – indeed could – do much better where their information needs are concerned.

(pp. 247–248)
The approach of choosing the most easily accessible information and leaving the rest is not an appropriate behavior, either (Badke, 2010). Such behavior is known as satisficing, which means taking just enough information to meet a need, thereby implying that just enough information is good enough. The general background to satisficing is given by convenience, characterizing both academic and everyday information seeking. It is mainly associated with the speed of search engines and the ease of access (Connaway, Dickey, & Radford, 2011).

Neylon (2011, p. 25) clearly expresses how we should approach IO.

The problem is not that we have too much information. We are an information-driven society; how could there be too much? The challenge is to make effective use of it. We do not need to block. We don’t need to limit. We need to enable. We need the tools for discovery. This is not a problem. It is an opportunity, and we will make much faster progress in solving the problems we face when we see.

It is information literacy education that is seen by many to be tool to reduce IO among users (Blummer & Kenton, 2014). Information literacy essentially seems to enable us to efficiently process all types of information content (Badke, 2010), thus counterbalancing IO. Apparently, it is at the micro-level where information literacy can be used as an efficient means of managing IO.

Closely allied to IO is personal information management (PIM) which is embedded in the PIC mentioned above (See page 80). The PIC model is made up of a pyramid comprising several layers. In this pyramid, information literacy occupies the middle layer, located above the elementary level which relates exclusively to skills, competencies, and abilities. Data literacy, which was mentioned earlier, can be placed on the same level as information literacy, that is, it can occupy the middle layer, located above the elementary level which relates exclusively to individual competencies (Gendina, 2008; Karvalics, 2013).

The re-evaluation of the PIC is a result of simultaneous developments in a number of fields. These fields are technological, such as the sprawl of mobile tools and the design of the network architecture as a personal area network. They appear in the economy as personal relationships with the consumers, the personification of the products, and following the online behavior of the users for data mining. An example of the developments in culture is that we are becoming culture producers or prosumers. In the field of politics, we witness the process of empowerment and the evolving de-institutionalization. Privacy and transparency laws make the public sphere visible and partly controllable.
Characterizing the novelties of the conceptual innovations, let us review the list of the most featured fields in the PIC:

- **Personal information space** denotes a progressively broadening cloud of discretely composed contents, personalized information services, and information processing tools, including tools that are wearable.
- **Personal learning environments** are more open, student-centered, personal task-focused frameworks than the earlier learning management systems (LMS). Clients can manage the content they produce, write blogs and build personal portfolios. If the goal is integrating or sharing personal files and documents, there are many special tools for structured content management, such as personal wikis.\(^3\)
- If we are talking about the mid- and long-term preservation and retrieval of these contents, the number of possibilities are countless to get down and apply the new tools of personal digital archiving (Marshall, 2008).
- Second-generation personal assistant platforms, personal digital secretaries, are an attempt to simplify the multi-channel interface environments with a striking means of differentiation.
- All the above-mentioned solutions can serve personal productivity improvement using software tools, complex applications, and involved experts. The progenitors, called personal network management (PNM) tools, could successfully invigorate after the explosion of social media networks and platforms. It was also inevitable that management science would identify separate fields for PIM and personal knowledge management (Frand & Hixon, 1999).
- A more comprehensive approach, personal knowledge governance, has already appeared, providing a strategic foreground to the digital support of personal development.

In the discourse started with PIM, the practice of and the training in professional skills are needed “to process the information, save time, and work more effectively” (Etzel & Thomas, 1999) in the organizational (business) environment—in other words: how do we manage the constantly and rapidly changing personal information technologies (hardware and software components, methods, services, etc.) at work. Later (Jones, 2007) and more recently (Jones & Marchionini, 2011) William Jones has started to broaden the definition by affirming that PIM is “the practice and study of the activities people perform to acquire, organize, maintain, and retrieve information.”

\(^3\)http://en.wikipedia.org/wiki/Personal_wiki.
for everyday use.” He elevates this onto a more general level by declaring that PIM is about taking charge of the information in our lives.

The organization of information can be interpreted differently, if we examine the recommendations of the American Library Association for information literacy (ALA, 1989). As is well known, IL begins with recognizing the need for information, and then identifying, finding, and evaluating it. The fourth step of the process is organizing information. We may think that this step is identical with the role that the library can play in organizing information (often called classification and indexing). This role, i.e., knowledge organization, is defined by Dahlberg (2006) as “… the science of structuring and systematically arranging knowledge units (concepts) according to their inherent knowledge elements (characteristics) and the application of concepts and classes of concepts ordered by this way for the assignment of the worthwhile contents of referents (objects and subjects) of all kinds.” However, organizing information is much more similar to the complex actions and processes that take place in a library. This means that it is not limited to organizing, but encompasses collecting and preserving information, as well as giving access to it, throughout this process. Thus, the principal difference between the library’s activities and PIM is that personal collections are in the possession of the users, who “give access” to themselves, being personal in the strict sense of the word.

In a PIM framework, the information life cycle of personal documents is managed in an individual’s own collection, which is informal, diverse, and expanding, and is created or acquired and accumulated by individuals in the course of their personal lives, and belongs to them, rather than to their institutions or other places of work (Williams, Leighton John, & Rowland, 2009).

Taylor (1968) reminds us that information seeking may also involve the consultation of personal files, which can be understood to refer to a domestic collection of books and other print documents (Shenton, 2009). A subjective but perfectly appropriate remark about his own (personal) library by Manguel (2008) can be generalized as follows. Most people have no catalog in their libraries. They usually know the position of the books by recalling the library’s layout as they have placed the books on the shelves themselves. In the digital environment, the situation is different as personal libraries also may be overwhelmed by information, especially in the form of computer files. This may cause problems, though not in regard to storage space, as in the case of print books as mentioned by Manguel (2008). The apparently preferred format for maintaining personal collections is the PDF as new items can be efficiently added to such collections (Newman & Sack, 2013).
PIM refers to the practice and study of the activities performed in order to acquire, organize, maintain, and retrieve information for everyday use, in the right form and quality (Jones & Maier, 2003). PIM allows users to organize information, to store it for future use with the help of their own systems. PIM tools offer solutions that can help to decrease the fragmentation in our information environment caused by the diversity of formats, applications, and tools (Franganillo, 2009). As mentioned earlier, diversity is one of the sources of IO, thus the surge of interest in PIM shows that it is one of the necessary reactions to it. Put differently, PIM is about the handling of information, stored on or available through analogue and digital tools, that is the organization of our personal information environment (Nagy, 2010). According to Bruce, Jones, and Dumais (2004), PIM emerges from the building, managing, and using of a personal information collection, which is a personalized subset of the information world used when we are faced with information needs. It can be defined as the space where we turn to first when we need information to do a task or pursue an interest. It is an organic and dynamic personal construct that consists of information sources and channels, cultivated and organized over time and in response to different stimuli.

The origins of PIM go back to early times. We can see this in an analogue form that is still in use: taking notes on paper in an ordered form, usually on index cards.

Both the definitions and this short historical overview show that PIM is a positively genuine personal occupation which is performed individually, mainly by professionals. Even if it has origins in the past, the interest in PIM has grown as a consequence of IO. This idea is supported by some definitions and approaches to PIM. For example, Franganillo (2009) states that from the set of information that is accessible, individuals create a subset of personal information which can be used when necessary. To achieve this, they apply their own, personal scheme. The fact that PIM can help in retrieving information that has been forgotten underlines its individual nature. We can also speak about personal information space, which is an abstract domain that encompasses all pieces of information that are under the control of an individual (Franganillo, 2009).

Among the variables of PIM identified by Bergman (2013), of prime interest is the organization of information. PIM is one of the answers to the problem of the availability of large quantities of documents in digital form and the technical ability to handle them with relative ease. It is of secondary concern that their preservation depends on the actual needs of the user thus
it is far from obligatory for them. Overall, this is why, when we speak about PIM, the word personal receives a strong emphasis.

According to Bruce, Jones, and Dumais (2004), PIM materializes in building, managing, and using a personal information collection, which is a personalized subset of the information world that we use when we are faced with information needs. It can be defined as the space which we turn to first when we need information to do a task or pursue an interest. It is an organic and dynamic personal construct that consists of information sources and channels, cultivated and organized over time and in response to different stimuli.

Mioduser, Nachmias, and Forkosh-Baruch (2009) call for seven technology-related literacies for the knowledge society. One is PIM literacy, which is applied by individuals when storing their information items in order to retrieve them later. Whether PIM literacy is a separate literacy is difficult to decide. In any event, it requires skills and abilities which are derived from information literacy.

In addition to this, there is personal knowledge management, qualified by Pauleen and Gorman (2011) as a way of coping with complex environmental changes and developments as well as a form of sophisticated career and life management. It is an emerging concept that focuses not only on the importance of individual growth and learning, but on the technology and management processes which have been traditionally associated with organizational KM.

PKM is not directly connected to IO, at least not to such an extent as PIM. The individual also plays a different role in it, firstly because of PKM’s close connection to the corporate world as an extension of KM. If we accept the definition of Brophy, that KM “is the process of creating and managing the conditions for the transfer and the use of knowledge” (Brophy, 2001, p. 36), this becomes clear. Besides KM, cognitive psychology, philosophy, and management science play a role. Its focus is on helping individuals to be more effective in personal, organizational, and social environments (Pauleen, 2009).

While the traditional view of KM is primarily concerned with managing organizational knowledge (including the knowledge that individuals possess), PKM is “personal inquiry”—the quest to find, connect, learn, and explore (Clemente & Pollara, 2005).

In the light of the ACRL Information Literacy Standards, PIM strategies gain especial weight, because they can help researchers to become aware of their information decisions and needs more explicitly. While citation
management software products (often provided by libraries) are useful for managing personal collections, libraries play a critical role in supporting the development of related strategies as librarians have the expertise and can provide advice on how information can be organized so as to better organize researchers’ personal collections (Exner, 2014).

Nolin (2013) identified areas of potential research support which have not been covered by traditional academic librarians or related professionals. One of these is the problem of overload with regard to both tasks and tools. However, if there is a lack of professional support, researchers may not utilize personalized digital research tools properly, thus they are unable to ease the burden of IO. To optimize researchers’ performance, personalized meta-services are required that match individual research practices with appropriate digital tools, based on a regular dialog between researchers and librarians and thus fine-tuned to researchers’ personal preferences. Such services have to be based on using information literacy tools and services.

Usually, researchers, especially in the humanities, aggregate vast quantities of information into their personal research collections. Their information needs dictate that this information must be managed in order to make proper use of it.

Gathering this information is accompanied by decisions to keep or discard a given item. The decision to keep information has at least two steps. The first is to decide whether the information is useful. If the given piece is judged to be useful, decisions have to be made in what format (print, electronic, or both) to keep it, where to keep it, and how to structure or classify it, taking into consideration its relationship to other items.

Positive decisions about keeping information are followed by creating some sort of personal information space, where recognition and retrieval have to be taken care of. The latter is especially important because most researchers “own” more objects than they can remember.

Personal research information collections differ from other personal information collections by the fact that they come into existence by a conscious effort to control the quantity of incoming information and the way in which it is organized (Bussert, Chiang, & Tancheva, 2011).
Chapter 1 – The Nature of Information Literacy

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CHAPTER 3
Critical Thinking and Information Literacy

3.1 CRITICAL THINKING

As a prelude to the substantive content of this chapter, consider the following concrete example of a set of information literacy activities. Imagine a student who is faced with the task of writing an essay. If we begin to ‘unpack’ the information literacy activities that this task requires, we immediately see the relevance of critical thinking (which we define and discuss further below). The first task of all for the student is to interpret what the question is asking him or her to do; is it seeking, for example, a description of a phenomenon or theory, is it asking for a much more in-depth evaluation of a theory, or is it asking for competing theories to be compared and contrasted? The answer to that very first question may not be immediately obvious and may require thought and critical reflection. Having interpreted the question, the next step is to identify relevant literature (and note that what is relevant is constrained by the assumed interpretation of the question). There are (at least) three possible answers to the question of where relevant literature containing applicable information comes from: the reading list provided by the lecturer, a broader swathe of reading beyond the reading list, as found by the student, and material identified within texts found by the student. Already, therefore, we have highlighted some important and malleable characteristics of (critical) thinking about an essay such as:

- reading the question/clarifying the topic;
- the disposition to go beyond prescribed reading lists;
- the ability to search for relevant literature independently;
- preconceptions about the topic and essay writing, which influence reading/selection of literature;
- the capacity to make sound judgements;
- the capacity to plan and implement a writing strategy designed to present a suitable (e.g., critical) response to the question;
- the disposition and ability to respond to feedback and critical commentary on one’s work.
Critical thinking is therefore a broad concept incorporating interpretation of the subject content, interaction of the student with the learning context, the student's reading strategies and information awareness. Taken together, these are perhaps the most immediately obvious key components of critical thinking in relation to information literacy, but as we will see below there are other relevant elements of critical thinking that must be considered.

Before launching into the detailed consideration of critical thinking, we should note that there are pedagogical implications of critical thinking and information literacy in terms of course design, teaching, feedback and assessment. For example, it is clear that the teacher’s choice of essay topic/question, selection of recommended reading and the nature of discourse in giving feedback and providing assessment are key factors in constructing the wider learning situation represented by the essay task. The lecturer’s degree of awareness of information literacy, his/her own capacity for critical thinking, particularly in relation to reflecting on his/her own teaching practice, and his/her capacity to motivate and guide students to good information practice, are therefore central to good pedagogic practice aimed at encouraging critical thinking. We will be exploring the pedagogical implications of what is known about critical thinking both in this chapter and subsequently in Chapter 6.

First, we will explore a number of questions that will help us to clarify the relevance of critical thinking for information literacy. For example: what exactly is meant by the term critical thinking? As we will see, the latter is an umbrella term that is used not only by psychologists but also philosophers and educationalists, and covers a wide range of distinguishably different aspects of thinking. Some elements of critical thinking are particularly pertinent to information literacy and we will focus in particular on these. Having identified some relevant aspects of critical thinking, we will examine (1) the issue of where within information literacy activities these three psychological phenomena manifest themselves, and (2) the issue of how this research literature should best be used to devise better information literacy instruction. In Chapter 4 we will consider how critical thinking relates to epistemology and to metacognition. Note that the literature on critical thinking extensively refers to ‘critical thinking skills’, and we have already (see the Preface) noted the theoretical tensions between the conceptualisation of psychological activities as skills as opposed to situated activities. We reiterate the view that the ‘situated activity’ perspective is more nuanced and preferable to the simple notion of a ‘skill’, since skills tend to be
conceptualised as collections of independent capabilities that can be discussed in isolation from each other and from the contexts in which they manifest themselves. We believe that both their independence from each other and from the influence of the context cannot simply be assumed. Where the notion of a skill is helpful, on the other hand, is in implicating the importance of practice at the activity for improving it. Since the literature extensively uses the word ‘skill’ in connection with critical thinking, we will in reviewing the relevant literature use that term, but the reader should bear in mind that our perspective is rather more elaborated than that, and that ‘skill’ is being used simply as a convenient shorthand.

The phrase ‘critical thinking’ encompasses a wide variety of patterns of thinking (eg, Brookfield, 1987; Ennis, 1987; Kuhn, 1991). Ennis (1987), for example, listed some 120 identifiably separate thinking skills that could all reasonably be called ‘critical thinking’, including, for example, identifying assumptions, identifying and dealing with equivocation, making value judgements, analysing arguments, asking and answering questions of clarification and/or challenge, judging the credibility of a source and so on. Scriven and Paul (2008) provide a useful overall definition of critical thinking: ‘Critical thinking is the intellectually disciplined process of actively and skillfully conceptualising, applying, analysing, synthesising and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning or communication, as a guide to belief and action’. As Mulnix (2012) notes, whilst there is a learned, skill-like aspect to critical thinking, it is more than the mere possession and exercise of skills: it is not just the blind following of a set of ‘rules for good thinking’, but a habit of thinking in which the thinker is disposed to use these skills and to accept the results of using them. This implies a degree of metacognitive awareness on the part of the thinker, a point to which we will return below.

A person who is capable of, and in the habit of such thinking is able to evaluate the quality of information he or she encounters to help with decisions about which elements of the information should be accepted and believed, as opposed to mistrusted and ignored. The relevance of such a conceptualisation of critical thinking to information literacy cannot be overstated: at every stage of the process, from initial formulation of an information need through to the final selection of information for attention and use, critical thinking is undoubtedly implicated. Critical consideration of the aim and scope of the information-seeking process would surely help focus the search process on relevant and promising areas; critical consideration of (for example) the selection of keywords and the choice of databases
in an online search would again limit appropriately the scope of the results obtained; and critical consideration of the materials obtained in the search according to relevant criteria (eg, peer-reviewed journals in an academic literature search or selection of favourite magazine or newspaper sources for a hobby-related search) would surely help the individual obtain what are for him or her the most satisfactory results.

Taking a broad perspective, it is possible to conceptualise much of the information that we encounter on a day-to-day basis as attempts at persuasive communication. Advertisements and political manifestos are very obviously attempts at persuasion, but arguably academic papers, television documentaries and many if not most of the pages on the world-wide web are also attempts at persuasive communication designed to get their reader or viewer to accept or agree with a point of view or theory, or to believe that some product or idea is worthy of their investment. Given the prevalence of such information sources/persuasive communications, the ability to critically analyse what one is presented with is one that has very general relevance. An ability to engage in critical thinking is therefore likely to not only raise students’ academic attainment, but also to enhance their ability to be effective employees and responsible citizens (eg, Perkins, 1989). Conversely, a poor grasp of these skills would clearly imply a poor quality of everyday thinking and problem-solving, and a degree of credulousness, among other difficulties.

Given the wide variety of components of critical thinking noted above, it is useful to try to simplify this plethora of thinking skills. One way of doing this is to conceptualise the core of critical thinking as a type of reasoned argument, and a number of authors have done exactly that (Billig, 1987; Kuhn, 1991; Mulnix, 2012; Perkins, Allen, & Hafner, 1983). Dealing with arguments and the logical relations between them (‘the ability to grasp inferential connections between statements’, as Mulnix, 2012, puts it) is at the heart of individuals’ formulations of their beliefs, judgements and conclusions (Kuhn, 1991), attitudes and categorisations (Billig, 1987) and scientific thinking (Newton, Driver, & Osborne, 1999). For example, Newton et al. argue that argumentative reasoning is central to the practice of science: the scientist must be able to articulate reasons and evidence that justifies particular views, to challenge particular views, to envisage views alternative to their own and to co-construct understanding in collaboration with colleagues. Therefore, it is possible to claim that argumentative reasoning is at the very heart of critical thinking, and that a focus on people’s skills at argumentative reasoning and on means of improving these skills would be an excellent way of investigating and improving critical thinking.
Adopting this perspective on critical thinking and following Kuhn (1991), we take ‘argumentative reasoning’ to include a number of abilities:

1. being able to differentiate opinions from evidence, so that the reasoner does not, for example, simply restate the relevant opinion when asked for evidence in support of it;
2. being able to support opinions with non-spurious evidence, that is, to have a good sense of the quality of different types of evidence and to select particularly compelling forms of evidence in support of one’s ideas, rather than unconvincing forms;
3. being able to envision opinions alternative to one’s own and to know what evidence would support these,
4. being able to provide evidence that simultaneously supports one’s own opinions while rebutting alternatives and
5. being able to take an epistemological stance which involves weighing the pros and cons (by reference to relevant epistemological criteria) of what is currently known.

From the perspective of those who employ university graduates, it is undoubtedly the case that the above set of behaviours is highly valued and a desired outcome of education (eg, see Harvey, Moon, Geall, & Bower, 1997).

A great deal of research has been conducted into the nature of argumentative reasoning, and on how such skills might be improved (eg, Anderson, Howe, Soden, Halliday, & Low, 2001; Kuhn, 1991; Kuhn, Shaw, & Felton, 1997; Perkins, 1989). Much of the research on this topic that has accumulated in recent years appears to imply that the quality of argumentative reasoning in the adult population is typically surprisingly poor (eg, Kuhn, 1991; Perkins et al., 1983). Consequently, an eminently practical concern is how to encourage learners to engage in these behaviours in a more systematic, searching and thorough fashion. We will first of all review some representative studies among the research on argumentative reasoning, present some critique of those studies and then go on to review intervention studies that have attempted to improve the quality of argumentative reasoning.

### 3.2 THE QUALITY OF ARGUMENTATIVE REASONING

Two early strands of research that appeared to suggest that argumentative reasoning skills in the adult population are somewhat weak are those conducted by Kuhn (1991) and Perkins et al. (1983). Both studies involved asking participants to reason about everyday matters on which they could
reasonably be expected to have had a prior opinion, and to analyse their responses from an argumentative reasoning perspective. Kuhn (1991) interviewed adults from a variety of educational backgrounds (for example, some with university education and others with community college education) and asked them to explain the causes of each of three social phenomena (school failure, unemployment and recidivists’ return to crime; it was anticipated that the school failure issue would be most familiar to participants, unemployment of intermediate familiarity and recidivism the least familiar). Participants were interviewed individually and asked to say what they thought caused the phenomenon in question, to justify their causal belief (‘why do you think X’), to articulate any alternative causal mechanisms that they could envisage (‘what do you think someone who disagreed with you might say was the cause of X’), to provide any justifications they could envisage for those alternative ‘theories’, and to indicate how they would rebut evidence in favour of theories they did not personally subscribe to. Kuhn found that the participants were willing to assert causal explanations, but often confused their ‘theory’ (Kuhn’s term for the participants’ causal explanations) with its supporting evidence, for example, by simply restating the theory when asked to provide evidence in support of it. They also frequently generated what Kuhn called ‘pseudoevidence’, which took the form of richly elaborated plausible scenarios that restated the theory rather than provided genuine evidence for it. Participants also frequently showed a poor ability to envisage alternative theories or evidence in their favour. Expertise in a relevant area made no difference to the quality of argument. For example, parole officers did not reason any better about the topic of recidivism than did other participants. However, Kuhn did find that a college-level education was associated with better performance in that degree-educated participants were better at generating evidence, envisioning alternative lines of causation, and having a more sophisticated evaluative epistemology than participants who had had no further education. However, the performance of even degree-educated students showed room for improvement. Kuhn tested a small number of participants who had expertise in philosophy, and this particular subgroup of participants exhibited the best overall performance.

Perkins et al. (1983) conducted a study which in many ways was similar to that of Kuhn (1991). Perkins et al. presented a written task in which participants considered issues such as whether passing a law to require drinks manufacturers to provide a 5-cent return on empty bottles and cans would reduce litter, or whether the reintroduction of military conscription would
increase America’s influence in the world. Participants were asked to reflect on the relevant issue for a few minutes, then, having decided what their position was regarding the issue, to set out a case for this position in writing. Their written responses were subsequently analysed for the quality of argumentative reasoning displayed. The results showed that participants often exhibited what Perkins et al. called ‘myside bias’, which was defined in terms of the numbers of arguments advanced in support of their preferred case as compared to the numbers of arguments advanced for its opposite. In other words, they were prone to engaging in one-sided argumentation, which presented arguments in favour of their own case and neglected possible counterarguments.

Perkins et al. also reported that the arguments provided by participants were flawed in various ways, for example, by failing to anticipate and effectively rebut obvious counterarguments. For example, if arguing in favour of military conscription by claiming that a larger set of armed forces would intimidate potential adversaries, they might neglect to anticipate or rebut the counterargument that, given that modern weapons of mass destruction can wipe out large numbers of troops, the sheer number of troops within an army is a less relevant consideration in weighing up possible influence than it would have done at previous points in history. Perkins et al. suggest that their participants build a mental model of the situation when considering the topic, and they examine this model for robustness. Perkins et al. contrasted two different patterns of critical thinking that they claimed were evident within their data when participants undertook this process of mental model examination. The weaker form of critical thinking was associated with what they described as a ‘makes-sense epistemology’. This is the tendency to minimise cognitive complexity by using the simple criterion of whether a given proposition makes intuitive sense and rings true, without critically analysing their mental model very deeply at all. The stronger form of critical thinking on the other hand was associated with a ‘critical epistemology’ in which participants understood what the potential pitfalls of justification are, and were accordingly more likely to critically analyse their own views by asking themselves when and why their mental model of the topic might fail, and building a model that was more robust against potential objections and criticisms as a result. Interestingly, Perkins et al. claim that whilst the makes-sense epistemology is quite prevalent across their participants, a critical epistemology ought in principle to be teachable.

Both Kuhn and Perkins explain their participants’ apparently unimpressive argumentative reasoning performances with reference to difficulties in
metacognition. Kuhn’s way of expressing this is to assert that participants think with their theories (ie, opinions) and evidence, rather than about them. As a result they have difficulty in coordinating opinions and evidence appropriately.

Kuhn’s and Perkins et al.’s work might appear to provide a somewhat bleak picture of the ordinary person’s argumentative reasoning skills. The educational implications of such a bleak picture would be profound, because, as we argued above, the patterns of thinking under investigation here are absolutely central to effective cognitive functioning. However, there are a number of methodological and theoretical issues in relation to this research that need to be considered before the findings can be accepted as being generally true.

On the methodological side, it is possible that particular features of the tasks set and of the testing situation might influence the participants’ performance. For example, the topics about which participants had to reason were chosen by the experimenter and may have been ones about which the participants knew very little, or had not given much prior thought to. In that connection, a subsequent study by Perkins (1989) is relevant. Perkins (1989) compared participants’ reasoning about a vexed personal decision that they had recently been pondering (eg, which university to attend, whether to get engaged), and which they might reasonably be expected to have given some prior thought to and in addition to have cared about, given the dilemma’s personal relevance. On the vexed personal issue, their performance was rather less biased and one-sided than was the case with a standard experimenter-supplied reasoning task.

Another possible reason for believing that the seemingly poor performance of ordinary adults in argumentative reasoning tasks might not be quite as bad as Kuhn and Perkins imply is the issue of participants’ motivation. In short, are participants unable to reason cogently, or is it the case that they are in fact capable but do not habitually do so? One of Perkins’s (1989) studies arguably shed light on this issue. The study involved ‘scaffolding’ the participants by having a reasoning expert working alongside them on a one-to-one basis. The reasoning expert did not supply content in the form of additional arguments, but instead prompted participants to think more deeply about arguments that they themselves had come up with. For example, the experts requested the participants to rank order the reasons they had thought of in terms of their quality, asked them to think of obvious counterarguments to specific propositions, and in general to reason more thoroughly and deeply. This scaffolding was applied particularly in relation to arguments on the non-preferred side of the argument (the ‘otherside’). The result was a striking
(700%) improvement in numbers of otherside arguments provided. There are two possible explanations for this result. The first is that whilst participants often do not spontaneously engage in good-quality argumentative reasoning, it is within their reach (within the Vygotskyan ‘Zone of Proximal Development’ or ZPD; Vygotsky, 1978). This implies that a training intervention could help effect improvement. The second, more motivationally focused interpretation, is that participants are able to reason cogently if supported (orpushed), but normally decline to do so. There is evidence for both of the above interpretations: Anderson et al. (2001), Kuhn et al. (1997), and Perkins (1989), have found that training interventions do indeed effect improvement. See Anderson and Soden (2002) for a review of some teaching interventions based on peer interaction that have demonstrated improvements in aspects of critical thinking. More recently, Abrami et al. (2012) and Behar-Horenstein and Liu (2011) have reviewed literature examining the effectiveness of teaching interventions in improving critical thinking more generally; this research is considered in a little more detail below. The second, motivational interpretation of the Kuhn–Perkins data alluded to above also fits with much other research (eg, Baron, 1994; Reason, 1990) suggesting that people are ‘reluctantly rational’, ie, that sound reasoning is effortful and participants are often insufficiently thorough in a variety of thinking tasks. There are, therefore, good reasons for being cautious about any conclusion to the effect that an apparently poor level of performance reflects some sort of stable, enduring cognitive weakness.

A more theoretical set of issues connected with the Kuhn–Perkins work concerns the very nature of the skills involved. Both authors discuss critical thinking/argumentative reasoning as a skill that can, like all skills, be improved with practice. However, doubts have been expressed as to whether the very term ‘skill’ is an appropriate one to use in connection with argumentative reasoning. For example, Schwartz, Neuman, Gil, and Ilya (2002) distinguish two perspectives on argumentative reasoning. The first is the traditional generic skill perspective (exemplified by the work of Ennis (1987)). This conceptualises critical thinking/argumentative reasoning as a set of general strategies of argumentation that are developed through the life span, that can be deployed flexibly in a variety of contexts, and that can be improved with practice in much the same way that one’s playing a sport or a musical instrument can improve simply by doing the relevant activity more often. The second is an activity perspective, which regards thinking and argument as social practices that are exercised and shared within a community, and that are evoked by particular tasks and contexts, rather than
skills possessed by individuals and that reside solely at the individual level (Cole, 1996; Resnick & Nelson-LeGall, 1997; Rogoff, 1998). Argumentative reasoning performance is thus conceptualised as an individual propensity that can be used in a variety of situations (ie, is ‘domain-general’, to use the jargon) within a skill-based account, and as a contextualised activity (where the tools available to participants, the social interactions that occur, the previous history of those involved in the interaction and their goals all exert influences on the quality of the participants’ argumentative reasoning performance) in the more domain-specific activity perspective.

The domain-generality versus specificity issue is of considerable practical importance. If argumentative reasoning were in fact domain-specific, as McPeck (1981) suggests is true for critical thinking in general, then argumentative reasoning will be closely tied to the epistemology of particular domains, a point argued also by Willingham (2007). There would, therefore, be ‘…no reason to believe that a person who thinks critically in one area will be able to in another’ (McPeck, 1981, p. 7). This would lead to pessimism about whether it would be possible to teach argumentative reasoning capabilities that would generalise beyond the academic discipline with which they were associated. A strong domain-specific view of argumentative reasoning would also imply that attempting to test this type of thinking by asking participants to reason about general social topics that they may know little about in the way that both Kuhn and Perkins did would produce meaningless results. Kuhn (1991) tackles the domain-specificity issue directly by arguing that argumentative reasoning occupies an intermediate location on the domain-specificity versus domain-generality dimension. In a later paper, Kuhn (1993) claims that her research identified forms of thinking that were domain-general in that they transcended the particular content in which they were expressed. Means and Voss (1996), provide evidence suggesting that there exists a domain-general component to argumentative reasoning.

Recent reviews of the literature (eg, Lai, 2011; Mulnix, 2012) confirm that the above summary of the literature is an accurate one. Mulnix (2012) argues that the case for an argumentative reasoning perspective on critical thinking is indeed a strong one, and that critical thinking encompasses both domain-specific (eg, the standards of evidence quality within a particular domain) and domain-general (eg, the ability to grasp evidential relations) elements. Lai (2011) reviews literature across psychological, philosophical and educational strands of work noting the various possible positions as regards domain-specificity summarised above, and summarising some of the literature on improving critical thinking; this is discussed further below.
Why should argumentative reasoning in particular be relevant to information literacy, as opposed to other more general elements of critical thinking? Certainly it is obvious that such critical thinking activities as judging the credibility of a source of information are (or perhaps we should say, should be) of vital importance in information literacy activities. It is also reasonably obvious why argumentative reasoning should be relevant to information literacy activities in an academic context: arguably, argumentative reasoning is quite simply at the heart of all academic work, regardless of discipline. Academic work consists largely of formulating well-constructed arguments supported by discipline-appropriate evidence (and of course, generating that evidence in the first place in the form of research activities). The case for adopting an argumentative reasoning perspective on information literacy activities within an academic context is, therefore, easy to make. But, for example, for more casual information literacy activities such as ones related to hobbies, for example, why should argumentative reasoning matter? The answer to this, we suggest, lies in part with our claim above that much of the information that we encounter on a day-to-day basis can be conceived of as a form of persuasive communication concerning what to believe, or buy, or do in the service of better health, beauty or wellbeing, or who to vote for, and so on. The critical deconstruction of such communications is important in making decisions about which ones we allow ourselves to be influenced by. Those emanating from sources for whom the argument is clearly self-serving, or within which there are logical non-sequiturs or contentious claims, we would do well to be cautious about and it is every bit as important, we would argue, to be able to do this in relation to ‘everyday’ information as it is in relation to more ‘technical’ information within academic contexts (See Chapter 9).

Having (we hope) convinced the reader of the relevance of critical thinking and in particular argumentative reasoning to information literacy, the question then arises as to how we can improve the quality of critical thinking, an issue to which we now turn.

### 3.3 PEDAGOGY AND CRITICAL THINKING: ATTEMPTS TO IMPROVE THE QUALITY OF CRITICAL THINKING VIA TEACHING INTERVENTIONS

There have been a large number of studies that have explored ways of improving aspects of critical thinking, and we will accordingly review a sample of studies that could be argued to have positive implications for how critical thinking can be improved via instruction within an information
literacy context. We will consider both general reviews of the literature on teaching critical thinking (e.g., Abrami et al., 2008; Behar-Horenstein & Niu, 2011; Lai, 2011; Ten Dam & Volman, 2004) and also more specific studies (e.g., Anderson et al., 2001; Kuhn et al., 1997; Schwarz, Neuman, Gil, & Ilya, 2003) to illustrate specific points.

Behar-Horenstein and Niu (2011) review 42 empirical studies involving attempts to teach critical thinking within a postsecondary context. Following Ennis (1989) they distinguish three different instructional approaches: the general approach in which critical thinking is taught as a generic stand-alone course without reference to specific subject matter, the infusion approach, in which critical thinking is taught within the context of a particular subject matter area but with explicit attention to critical thinking within the subject area teaching, and an immersion approach in which critical thinking is taught within the context of a particular subject matter area but without explicit attention to critical thinking within the subject area teaching. They concluded that greater success resulted when the teaching of critical thinking was explicit rather than implicit, and that treatments that lasted longer tended to result in greater degrees of success than treatments that were shorter in duration. These conclusions fit with the notion of critical thinking as a skill (the literature on skill learning demonstrating clearly that repeated practice of a skill helps enhance it, hence the relevance of the time dimension). They also fit with the notion that metacognition is a key element of critical thinking – those courses with an explicit emphasis on critical thinking being more likely to foster metacognitive monitoring of thought processes. The finding that explicit treatment of critical thinking during instruction yields better outcomes than implicit treatment of critical thinking is supported by findings from Marin and Halpern (2011) and the outcome of the meta-analysis by Abrami et al. (2008) discussed further below. Mulnix (2012) also notes the importance of repeated practice for the promotion of both skill enhancement and metacognition.

Abrami et al. (2008) conducted a meta-analytic review of 117 experimental studies that sought to enhance critical thinking. Across all of the studies reviewed, there was a significant gain in critical thinking as a function of instruction, with stronger gains when critical thinking was associated with explicit teaching objectives compared to when it was associated with implicit teaching objectives. Better results were also found when the teachers or instructors had had special advanced training in preparation for teaching critical thinking skills. They also noted that collaboration among students while developing their critical thinking skills is advantageous.
Abrami et al.’s review provides positive evidence that critical thinking can indeed be improved by teaching interventions.

Ten Dam and Volman (2004) undertook a qualitative review of 55 studies examining the effectiveness of instructional formats for improving critical thinking. They conclude that the characteristics of instruction that are assumed to enhance critical thinking are: ‘paying attention to the development of the epistemological beliefs of students; promoting active learning; a problem-based curriculum; stimulating interaction between students; and learning on the basis of real-life situations’ (p. 359). They conceptualise critical thinking as the acquisition of the competence to participate critically in the communities and social practices of which the learner is a member, thus acknowledging a domain-specific element and adopting a social constructivist perspective on critical thinking.

As noted above, meta-analyses and reviews of the literature repeatedly emphasise the importance of students interacting together, preferably on meaningful tasks. Examples of studies that have attempted to enhance the quality of argumentative reasoning using peer interaction as a teaching and learning method include those by Anderson et al. (2001), Kuhn et al. (1997), and Schwarz et al. (2003). Approaches using peer interaction and learner–learner discussion are often justified with reference to Piaget’s theory of development (see the section in Chapter 5 on social constructivism). Additionally, Crook (1998) suggests two other possible mechanisms that might underpin the benefits that can be obtained from collaborative working. First, during discussion collaborators have to articulate their thoughts publicly, which forces the clarification of the nascent thoughts (see also Palincsar, 1998), and renders them available for exploration. Second, collaborators may co-construct a single, systematising object of thought (such as a hypothesis or a prediction). Accordingly, a number of investigators have applied peer interaction-based teaching methods to argumentative reasoning skills (Anderson et al., 2001; Kuhn et al., 1997; Schwartz et al., 2002). The Kuhn et al. study involved repeated discussion with different partners of the topic of the effectiveness of capital punishment as a deterrent to murder, whilst the Anderson et al. study involved explicit instruction in evidence-based justification with specific reference to proposed project work, followed by discussions of the design of the students’ own projects. All three of the studies cited above demonstrated that repeated engagement in peer discussion on a topic results in improved argumentative reasoning (eg, with greater provision of two-sided and comparative arguments and greater awareness of the coexistence of multiple views in the Kuhn et al. study, and
better use of evidence-based justification in the Anderson et al. study as a function of having participated in the peer-based teaching intervention).

To summarise, argumentative reasoning skills can fairly be claimed to be at the heart of critical thinking: the ability to infer the relations among arguments with a particular focus upon evidence and justification is central to critical thinking. As noted above, there are reasons for believing that argumentative reasoning capabilities are central to a wide variety of information literacy situations. Whilst there is debate regarding the issue of whether critical thinking skills are generic and apply across situations or are instead domain-specific and therefore tied to particular academic disciplines, there is evidence that good critical thinking has both general and specific elements and that argumentative reasoning skills constitute a generic set of critical thinking skills. It can also be concluded that one strong implication of a skills perspective on critical thinking, namely that argumentative reasoning can be improved as a function of practice, has received empirical support. Improvements in such skills have been more strongly demonstrated when explicit attention is paid to critical thinking alongside subject matter material, when meaningful problem-based learning tasks are employed, when learners interact with each other over their tasks, and when instruction is spread over a prolonged teaching intervention lasting for weeks rather than ‘one-shot’ instructional sessions. There is here a striking implication for information literacy education. Given the centrality of critical thinking/argumentative reasoning for information literacy, and given the unsatisfactory results from single-session ‘one-shot’ teaching interventions in improving the effectiveness of critical thinking, it follows that single-session, one-shot teaching interventions will be highly likely to be unsatisfactory for teaching information literacy. This in turn implies that information literacy education would benefit from a curriculum that does not simply list a set of desirable characteristics to be inculcated, but one that embodies an extended temporal progression of activities (possibly extending throughout the undergraduate’s entire degree programme) that permits and facilitates repeated, guided practice in relevant information literacy activities that develop and build in complexity and sophistication over time, in much the same way perhaps that research methods teaching typically takes place within a variety of disciplines (See Chapters 5 and 6).

The distinction between a library/digital-skills-based notion of information literacy and wider conceptions of social and epistemological development has implications for how we should teach information literacy, and these implications sit well with our comments above about the desirability
of having an extended temporal progression of activities in teaching information literacy. There is currently widespread agreement that the ‘one-shot slot’ approach is unsatisfactory for all but the most narrowly described teaching and learning. That said, there will obviously be a place for short introductions to more complex designs, or to top up knowledge and skills with new material. However, it is clear from the Johnston and Webber definition (see page 8), and the various elaborated listings of information literacy capabilities such as the ACRL Standards, end the UNESCO statement on Media and Information literacy, that more complex pedagogical designs are required. How might we proceed?

One option could be to adopt a ‘short-course’ approach. For example, this could map the various elements of an iterative searching process onto an existing course template. The following seven elements could be mapped onto seven sessions: acknowledge information need; identify sources; devise search strategies; conduct search; evaluate results; refine search and repeat as required; apply final results to the perceived need. Sessions would vary in length, mode and design of activities, depending on the constraints and opportunities of a given context. For example a first-year university class conducted in attendance mode might deploy the sessions as part of a lecture sequence spread over 7 weeks. This could take the form of seven workshop sessions, possibly backed by tutorial discussion. Lectures on information literacy could be offered outwith subject study timetables or be incorporated as part of subject teaching. Assessments and examination of attainment could be added either as a separate feature or as part of the assessment of subject learning. Evidently a different concept of teaching would alter the design options and could result in a course, which did not use lectures at all. For example, a problem-based learning approach using projects, team activities and so forth would be an obvious alternative scenario.

In a workplace context, the seven sessions could be designed as a 1-week training course aligned to the specific requirements of a given staff group. Equally the seven sessions could be condensed from 7 days to say 3.5 or 4 days, depending on the needs of the given workplace. Moving from the idea of attendance mode, one could readily envisage an online version being created. A seven-session MOOC is quite feasible and could be made widely available free to the adult learner communities. Allied to both the academic and workplace scenarios sketched here, would be the need for appropriate staff development for lecturers and librarians, to complement their disciplinary and professional expertise. There might also be a need for such provision for learning technologists engaged in designing an information
literacy MOOC. One could, therefore, envisage a need to create some workshops to address the staff development requirement.

Arguably it will be much easier to create a sequence of sessions based on a process model of information literacy, than to design a course aimed at engaging learners with more holistic and nuanced accounts. For example, the notion of developing information literacy as ‘...leading to wise and ethical use of information in society’, is perhaps a more complex pedagogical and organisational development challenge. We suggest that our themes of critical thinking and social epistemology are central to devising appropriate pedagogical designs to meet such holistic conceptualisations of information literacy and to enhance the skilled performance of information literacy over time. (We will discuss the issue of course design in more detail in Chapter 6.)

3.4 CONCLUSIONS

Returning to the example with which we opened this chapter, consider again the lecturer setting an essay for a student. We noted earlier that both critical thinking and information literacy are (ideally) intimately bound up in the initial setting of the question and provision of the reading list by the lecturer, the interpretation of the question and writing of the essay by the student, and the final assessment and grading of the resulting essay by the lecturer. What is the contribution of librarians to this extended process? Whilst the lecturer’s pedagogical practice for information literacy can be supplemented by contributions from librarians, the main responsibility for initiating information literacy education resides with the lecturer. Discharging that responsibility goes beyond the individual teaching practice of that particular lecturer to include collaborative pedagogical decisions on the nature of curriculum and the design of particular modules and classes within degree programmes.

That said, at any point in the essay experience the student can go adrift – for example, through insufficient motivation; failure to understand the question; inadequate search skills; misunderstanding of the intellectual ‘content’ of a given source and so on. Staying on track is perhaps effected by a combination of guidance and training by lecturers, librarians, study advisors and peers. To that end mechanisms of advice, guidance and feedback need to be put in place so that student efforts can be supported. However it may be that the key characteristic which needs to be developed by the student over time is metacognition – that is, the conscious, deliberate monitoring and regulation of one’s own thought processes. We turn to an exploration of that area of psychological literature in the next chapter.
Chapter 2 – Critical Thinking and Information Literacy by Anthony Anderson and Bill Johnston

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CHAPTER 2

Information Literacy Skills in the Research Process

2.1 INTRODUCTION

Research is deeply founded in previous research. One of the main goals of research is to bring forth new knowledge. Therefore, a researcher must be informed about what has been published in the past.

To create an overview of present knowledge, relevant information searches must be conducted. This requires good searching skills. Researchers must either have such skills themselves, or they will need qualified help from the librarian to conduct the necessary searches. Because information literacy skills are key, both throughout the research process and in teaching and advisory activities, it is preferable that both researchers and tenured professors obtain a reasonable level of skills.

The competence building should be focused on two fronts: The daily support to already tenured personnel should be designed to encourage scholars to develop their own level of information literacy skills and overview of available sources over time.

Furthermore, students should be introduced to information literacy skills throughout their education. It is especially important to ensure that postgraduate students get thorough training in how to search, evaluate and use sources. Courses in information literacy for PhD students is a strategically important activity which libraries should prioritise, primarily because it is of vital importance to the quality of research that new candidates have familiarised themselves with the forefront of new knowledge. Another reason why this should be prioritised is that it provides an eminent arena of cooperation with experienced professors, and fine-tuning of the information literacy skills of postgraduates to the latest developments in the field.

This book aims to give some suggestions as to how the library can be a part of the formal doctoral education, and how communication and collaboration directly between the librarian and the postgraduate student can help develop better research support services. In the following, different understandings and approaches to information literacy will be presented. Understanding the theoretical framework of information
literacy is a favourable way of understanding how it can be applied to practical professional situations.

2.2 WHY SHOULD THE LIBRARY TAKE PART IN RESEARCH?

The library is part of a larger organisation and follows the university’s strategic goals. Information literacy is the ability to transform information into knowledge and to pass this knowledge on in an ethical manner. This is also true for research, but researchers also have to get their knowledge published.

During the last 30 years, a digital revolution has made vast quantities of information available through the Internet. Good searching skills and critical thinking have never been more important to conduct high-quality research. Researchers need to be information literate to navigate the information available. Information literacy can be viewed in different ways, and traditionally the behaviouristic, the phenomenological and the sociocultural views have been applied to this in different ways. These three views will be presented in this chapter.

The library taking a more active part in research also has implications for what part the library plays in the university organisation. From being a collection of books and a circulation desk that library users could approach with questions and inquiries, the library is moving in a direction in which the librarians are moving out from the circulation desk and into the research environments. More involvement in the research environment also demands a higher level of competence and knowledge about the research process from the liaison librarians. From a time when knowing the collections was enough, librarians must now be familiar with research methodologies and subjects to be on top of their game. This knowledge is best obtained through interaction and communication with the university’s researchers.

The library should take part in research not only for the sake of researchers, but also for the sake of the library’s future. If the library does not follow the development that is taking place, it will be left behind. Researchers’ needs and work methods are changing, and the library must change with them to be a relevant and important part of the university.

2.3 DEVELOPING A COMMUNITY OF PRACTICE FOR RESEARCH SUPPORT

Librarians working with research support would also benefit from talking with each other and sharing experiences, developing what can be referred to as a community of practice. ‘In a nutshell, a community of practice is a
group of people who share an interest in a domain of human endeavor and engage in a process of collective learning that creates bonds between them: a tribe, a garage band, a group of engineers working on similar problems' (Wenger, 2001). Creating a community of practice for liaison librarians working with research support has also been described in a study from 2015 (Daland, 2015). Not only does a community of practice provide the opportunity to discuss challenges and experience and develop a stronger professional identity, it also makes for learning and developing skills. This can make for a higher level of self-esteem for librarians and further to a higher level of work satisfaction.

2.4 DIFFERENT APPROACHES TO INFORMATION LITERACY AND LEARNING

Since its origin in 1974, information literacy has been studied and described in different ways. Knowing how information literacy can be understood can help library personnel understand how it can be taught and learned. Three different approaches stand out as the most common views on information literacy and will be presented in this chapter. The field has changed from the behaviouristic view as the most commonly used way of viewing information literacy towards a more sociocultural way of understanding information literacy skills. As the quantities of information are increasing, subject-specific and specialised skills become more and more important.

2.5 THE SOCIOCULTURAL APPROACH

The sociocultural view on information literacy states that it is something developed in community with others. Developing information literacy skills is concerned with how information is found and used in a given social situation. The sociocultural perspective states that information literacy is deeply situated. It states that individuals develop information literacy via social interaction in a context in which these skills are considered of value. People are socialised into a context and situated within this context (Lloyd, 2012). In research, this means that postgraduate students are socialised into an academic environment with given work methods. In a sociocultural view, information literacy is often thought of as the plural information literacies as information handling skills are highly complex and related to the subject at hand.

Lloyd’s article from 2007, Learning to put out the red stuff (Lloyd, 2007), is concerned with a sociocultural view of information literacy skills and how these are used in a work environment. In this article, a firefighter’s skills and
ability to learn through a social setting are the focus. When starting a new job or entering a new field of research, one needs to get familiar with the ways of working, the tacit knowledge, the explicit knowledge and the traditions of the subject. This is often best learned through experience. Through experience, one is included in the environment and can observe and learn the ways of working. In many ways, academia is based on the understanding that one can acquire knowledge through text, and, in this way, the sociocultural view stands out and differs.

2.6 THE BEHAVIOURISTIC APPROACH

Although some research skills are highly situated and subject related, there are certain generic skills that should be mastered by anyone with an interest in research. Generic information literacy skills, such as searching, source criticism and ethical use of sources is a minimum of skills that need mastery to conduct independent research of a certain quality.

Easily detectable generic information literacy skills for research include: searching, source evaluating, referencing and publishing. Generic skills are measurable and often viewed in a behaviouristic view. The behaviouristic view focusses on skills that are measurable and transferrable. This means that generic skills can be taught in one setting, and can be transferred to other settings. According to the American Library Association, an information-literate individual is able to:

- Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into one’s knowledge base
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal and social issues surrounding the use of information, and access and use information ethically and legally

(American Library Association, n.d.)

The behaviouristic view has been the traditional view in information literacy, but it is highly simplistic in explaining a complex phenomenon.

2.7 THE PHENOMENOLOGICAL APPROACH

Phenomenology is concerned with how people understand, perceive and make use of different phenomena. A phenomenological understanding states that information literacy is not transferrable and generic but situated
Information Literacy Skills in the Research Process

and changes with content, situation and context as this is experienced. It distinguishes itself from the behaviouristic listing of measurable skills. Phenomenology sets out to understand information literacy, as behaviourism wants to measure it. The focus is also more on the individual and how he or she experiences it, with limited interest to the social environment (Pilerot & Hedman, 2009, p. 26)

One interesting study using a phenomenological approach is Abdi’s doctoral dissertation in which she studied how web professionals experience information literacy (Abdi, 2014). ‘Phenomenography is an interpretive research approach through which the researcher is enabled to describe a phenomenon in the world through the eyes of others’ (Marton & Booth, 1997, cited in Abdi, 2014, p. 5). A phenomenological view of information literacy is highly aware of the subjective experience behind statements describing information literacy. In other words, one is describing how information literacy is experienced, not necessarily how it in fact is.

2.8 PRACTICAL APPROACHES TO INFORMATION LITERACY

The information landscape is changing, making more information than ever available at the tips of researchers’ fingers. They do not even have to visit their library to access it, or even leave their offices. However, accessing the right research and using it in an ethical manner, still requires some training. Traditionally, the behaviouristic view on information literacy has been dominating how librarians assess library users’ competencies. In later years, the sociocultural approach has gained more influence and become a more important way of understanding information behaviour. It is not enough for researchers to know basic information searching skills, they need to be socialised into a subject-specific tradition. They start as novices and, hopefully, end up as experts. This is not only the case for researchers, but for all work environments, as illustrated in Lloyd’s article from 2007. Lloyd (2007, p. 183) emphasises that information literacy is ‘a way of knowing about an information landscape through embodiment within context’. This is also a strong argument for liaison librarians having subject-specific knowledge of the field of research they are meant to support. Lloyd illustrates that knowledge is based on familiarity with the information landscape at hand, and this can only be achieved through experience and practice in the field of research.

Many liaison librarians do not have a PhD degree in the subject for which they are expected to provide research support. This often results in low self-esteem and uncertainty whether they are able to provide research support.
Several studies outline types of important subjects to be taught in library courses for doctoral students. Searching, source evaluation, citing, reference management and bibliometrics are listed as important subjects. The participants show a higher level of confidence after attending the courses and see this as important. Madden (2014) also concludes that ‘By making itself known, a library can enhance its role in supporting research, helping to reduce anxiety and potentially decrease attrition rates’ (p. 103).

### 2.9 UNIVERSITY STRATEGIES AND GOALS

Most universities will have a goal of becoming a centre for excellent research and climbing the list of university rankings. Research of high quality is an important instrument to make this happen. For high-quality research, a well-structured support system must be present. This support system consists of academic staff supervisors, resources provided for the institution, adequate administrative procedures and general institutional quality for research (Moses, 1994, p. 6).

The library is an important part of this support system. The library and librarians have a great level of competence in information structures and sources. Putting this knowledge in a system in which all researchers benefit will be a fruitful strategy to help researchers be more productive. Often times, much time is spent on things that could be done more efficiently.

### 2.10 INFORMATION LITERACY AND RESEARCH

The library is undoubtedly an important part of research and of research support. Universities focus greatly on the throughput of PhD candidates and production of excellent research. Information literacy skills are important when conducting independent research of high quality. A goal for postgraduate students is to get them started with good information and research habits as soon as possible, making it possible for them to ‘hit the ground running’. Well begun is half done, and information literacy skills making research and information handling more efficient will be a good start.

Although information literacy traditionally has been viewed and evaluated in a behaviouristic approach, more recently the focus has shifted to a more sociocultural view. This makes sense in the respect that researchers, and especially new researchers as are postgraduate students, are in the middle of the process of being socialised into a research and subject tradition. Certain skills are needed to conduct research, but this will differ with
Information Literacy Skills in the Research Process

Subjects, methodologies and fields of research. Therefore, not all information literacy skills will apply for all researchers. Some researchers will even be able to do research without even a slightest bit of information literacy skill if we measure it in a behaviouristic way. Systematic searching and reference management may not be top knowledge among all researchers, but they may have other skills, perhaps in methodologies that are brilliant, and they are able to receive help from others to do these things for them. However, as the number of researchers increases, the demand to conduct independent research is also rising.

Faced with research, information handling is highly complex. However, some generic information literacy skills should be emphasised to make the library contribution visible in research. The traditional library roles as keepers and guides to information are still important. Teaching researchers how to search for, evaluate and use sources in an ethical manner is still a large part of the library’s contribution.

When enrolled in PhD education, postgraduate students are on their way from novice to expert. To make this transition, some generic skills should be mastered. The instruction provided should be relevant to their field of research, but for most postgraduate students the following skills are relevant:

2.11 SEARCHING

In the start-up of a PhD programme, one needs to do a literature review to investigate previous research. As research is becoming increasingly interdisciplinary, a range of databases could be suggested. Librarians have the overview of databases that new students do not and will be able to provide selection advice. In “Chapter 8, Important Research Support Services” an introduction to search methodology success (Zins, 2000) will be given as a suggestion to how library instruction can be given to postgraduate students.

2.12 SOURCE EVALUATION

Although most postgraduates feel confident in evaluating sources, some additional requirements have been added as they step into the reality as a researcher. Some journals are more sought after than others when it comes to both impact factor and academic ranking. This may not have been a focus point in their Masters thesis work.
2.13 ETHICAL USE OF SOURCES

Postgraduates will not only use secondary sources and literature, but also primary sources they gather themselves. Interviews and questionnaires must be treated in an ethical manner. They will also have to use a larger quantity of sources than they have done before. Good habits organising references and using a quality reference management programme will be of use to postgraduates. Some may be reluctant to use this, because they did not do so in their Masters thesis and managed fine. Oftentimes, they will regret not doing this during their thesis work, but by then too many references have been manually added, and it will take too long to import them to a reference management programme.

Good organisation of references will make ethical use of sources easier, hence, decreasing the chance of plagiarism.

Making library services available and providing training in information literacy skills could contribute to more efficient research and consequently better research results and high-quality publishing. This is also likely to fulfil university strategy goals.

2.14 CONCLUSIONS

Information literacy is important to research. To conduct high-quality research and help their universities climb national and international rankings, fulfilling university strategies and goals for research, researchers should be information literate. This must be made a priority in university management, and academic libraries should work together with other departments in the university to strengthen and display their positions as an important part of research. Academic libraries must also be aware of their responsibility as a part of the support system for excellent research.

When it comes to information literacy skills in the research process, it should be as integrated as possible. Finding the right information and using it in an ethical manner is important for all researchers. How this is conducted is different from research environment to research environment. Therefore, information literacy instruction and training must be adjusted to the field of research. It is also desirable that the liaison librarian providing research support for the research environment has knowledge about the subject at hand and relevant literature and methodologies.

Close collaboration between librarians and researchers is a fruitful way of developing information literacy skills and a deeper understanding of the
research process. It is also a useful way of learning how information literacy and library services are important to research.

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Visual literacy meets information literacy: how two academic librarians combined information science, and design in their careers

Mary J. Snyder Broussard and Judith Schwartz

Introduction

There is growing discussion of “visual literacy” and a corresponding increase in the use of images and visual media in higher education. The Association of College and Research Libraries (ACRL) (2000) recently felt it was time to address this trend when they published the Visual Literacy Competency Standards for Higher Education in 2011. Additionally, one of the rationales for the need to revise the ACRL Information Literacy Competency Standards is an “explosion of [visual, data, and multimedia modes of scholarship and learning] and the increasingly hybridized, multi-modal nature of learning and scholarship require an expanded conception of information literacy learning and pedagogy beyond the mostly text-based focus of the Standards” (Framework Taskforce, 2014: 3).

Mayer and Goldenstein (2009) demonstrate how the rising use of images in undergraduate teaching and learning is affecting library services. They found that 85% of librarians who responded to their survey reported that they were instructing students on how to find images for school projects, including presentations, papers, posters, exhibits, as well as for fine arts, and theatre inspiration. Many also help faculty to find images for class lectures, class analysis exercises, online instruction, and publication. Finally, a small but significant number of respondents reported helping campus public relations (24%) and development offices (21%) locate images. Nearly half of respondents subscribed to ARTstor, with others reporting subscriptions to other image and map databases.

Not only do academic libraries need visually literate professionals who can assist library users in finding, formatting, creating, and displaying images ethically, but libraries also require attractive and effective visual materials for their website, marketing, instruction, and archives. Because, budgets in academic libraries are usually too restricted to hire professional graphic designers and visual design is often so intertwined with professional philosophies and instructional design that librarians with backgrounds in graphic design are well placed to serve many of the libraries’ design needs. This chapter will introduce two academic librarians’ previous experiences in graphic design departments and demonstrate how those experiences enhance their role as library professionals.
**Visual literacy**

ACRL defines visual literacy as: “a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media” (Hattwig, D., Burgess, J., Bussert, K. & Medaille, A. 2011). Five of the seven Visual Literacy Competency Standards are directly adapted from ACRL’s Information Literacy Competency Standards. The additional standards include an explicit need to interpret and analyze visual media and the importance of being able to create new media. Librarians with graphic design skills are uniquely able to provide library users with advanced assistance in the last two standards, which involve creation and ethical use of images.

Standard 6 of the Visual Literacy Competency Standards states, “The visually literate student designs and creates meaningful images and visual media.” Librarians are increasingly collaborating with faculty and various support services on campus to support students as creators of new knowledge. In many (if not most) libraries, reference librarians offer technical help when students ask computer and software questions. Some libraries even offer multimedia labs with design software and access to large-format printers in the library. Regardless of whether or not one’s library has such a lab, there is an increasing use of images in academic courses and students are expected to include images in posters, presentation slides, displays, and papers. Librarians are a readily available and highly visible source of help to these students who do not necessarily distinguish such questions from those related to research help. Reference librarians are often helping students print, create and manage PDFs, find images, save and format those images, select the right software for the purpose, and use formatting features in commonly used word-processing programs.

Having a background in graphic design and photo manipulation greatly enables a librarian’s ability to help students as image creators. It enables a librarian to assist students with the tools in design programs, use image-related equipment, and take advantage of the lesser-known design tools in more familiar programs such as PowerPoint, Publisher, and Word. An advanced understanding of image quality, file size, and the merits of various file types better enables librarians to help users prepare images for the end product. For example, a poster will likely need to be converted to a high-resolution PDF to be sent to a printer to avoid pixilation in large format. In contrast, an image for a website should be set to the final dimensions, and then saved as a low-resolution JPEG, PNG, or GIF file (each of which has its own benefits and drawbacks) in the smallest possible file size in order to load as quickly as possible. Power-Point slides can be compressed for better delivery of online learning or to be loaded into course management systems with file size limits. Librarians with graphic design experience are better equipped to assist with these advanced image creation questions.

Standard 7 of the Visual Literacy Competency Standards addresses the need to understand the “ethical, legal, social, and economic issues surrounding the creation and use of images and visual media.” When one has experienced the need to adhere strictly to the copyright laws that govern images in the publishing and marketing world, one develops a different perspective on promoting the ethical, and legal use
of images created by others. A solid understanding of copyright and intellectual property is critical in the publishing field. The materials being produced are often widely distributed. The publishing industry takes these very seriously because intellectual property can be worth a lot of money and not respecting the established legal guidelines can leave a publisher or advertising firm subject to expensive lawsuits. Considerable resources are spent documenting who owns the intellectual rights of the materials to be published.

Intellectual property, plagiarism, and copyright are foundations of the ethics of librarians, though their manifestations are different from the publishing world. Librarians are legally bound by the contracts with content vendors, but beyond that they tend to be more concerned with the ethical side of this issue, while the marketing and publishing world tends to be more immediately concerned with the legal side, and students and faculty are granted a great deal of freedom under Fair Use for educational purposes. Yet sometimes it is useful to have a stronger understanding of the legal side, and that is where a background in publishing is particularly useful. Many librarians do not realize how different (and vastly more complex) copyright laws for images are than for text and how rights for use differ greatly depending on whether the image will be used within the classroom or for campus marketing materials such as theatre posters. A background in image rights research assists a librarian in providing faculty with copyright assistance for publication.

**Design needs in academic libraries**

Before entering librarianship, neither author was aware of the great need for design in libraries. In library school, Judith learned of the many ways libraries use art and design including branding, wayfinding, signage, renovations, curating revolving art shows, library art installations, and academic publishing in addition to presentations, newsletters, and literary publications. It was not until Mary began her professional career that she found her desire for creative projects was well matched to public services in an academic library. This section will focus on four areas in which the authors have experience with design in academic libraries: marketing, web development, instruction, and archives. While some of these needs can be outsourced to other campus departments or vendors, there are many reasons why some of these design jobs are best done by a librarian.

Marketing and outreach directly affect what potential library users know about and feel towards the library. Academic libraries compete with students’ natural tendencies to run to free and easy information that often does not meet the quality standards of their assignments. Libraries have similar missions with faculty, staff, and the broader community. They need to establish their brand as a source of high-quality print, and online resources, attractive spaces for individual and group study, and high levels of customer service. Above all, they must convey themselves as user-centered, and that begins with the marketing material inviting potential users to the physical and virtual library.
Effective marketing relies heavily on visual design as the visual appeal is what initially grabs viewers’ attention. Langton and Campbell (2011) write, “The world is visual. We use our eyes to take in much of the content that influences our behavior, tempers our reactions, and informs our decisions. Whether it’s on the Web, in a brochure, or live in person, the most effective solutions are the ones that unexpectedly grab our attention”. Before viewers even read the library’s marketing materials, they are absorbing the non-verbal messages communicated through images, color, and layout. Students (the primary audience of academic library marketing) are bombarded with posters and email messages. When they see a poster from the library, they make instant, unconscious judgments based on visual design about whether reading the text is worth their time and energy. If the answer is no, they will not even read the text. It is therefore important for the library’s printed and digital marketing materials to be visually attractive in order to be effective.

Outreach events often bring a particular segment of the wider community into the library with the assumption that some attendees are not regular library users but have the potential to become so. These events also tie into the non-academic mission of the larger institution, which is to provide students with fun and safe extracurricular activities that become an important part of a student’s overall college experience. Exactly what such an outreach event entails will vary depending on the particular needs of a library’s users and the organizational culture of the larger institution. For example, an outreach event at a university of mostly non-traditional commuter students may be a formal open-house event, while an event at a residential college with mostly traditional students may look a lot like a program one would expect to find at a public library. Regardless of the type of culture, these outreach events often involve visual design to engage participants, as we shall demonstrate later in this chapter.

The academic library’s website serves as a front door to the library’s online information resources and finding tools, marketing the library’s services and collections, and providing various instructional resources. Visual design plays an extremely important role in website development, being nearly indistinguishable from usability, information architecture, and overall effectiveness (Krug, 2006; Nielsen & Loranger, 2006.) Lindgaard, G., et al. (2011) cite numerous studies that tie visual appeal of a website with perceived quality, usefulness, and trustworthiness. Many academic libraries are either required or choose to use the larger institution’s web theme, which was most often developed by a group of trained and skilled graphic designers, web coders, and marketing specialists. This requires librarians to negotiate with those administrators responsible for that theme to make sure it meets the unique needs of library users. However, if such negotiations are successful, this facilitates the library in providing their website visitors with a professional, and visually appealing first impression.

Within the institution’s web theme, the library should have a visually literate individual to create clear, uncluttered pages, use images to portray effective messages, and create an information structure that allows users to easily find what they are looking for. Newell (2004) studied library website images and found that librarians needed a greater understanding of visual communication principles as they were inadvertently communicating undesirable messages to potential library users. Library website
managers should exploit the power of images to portray it as a user-centered organization dedicated to quality.

A recent survey of American library directors shows that a dedication to library instruction is a nearly universal priority of academic libraries (Howard, 2014), and design also plays a role in creating effective instructional materials. In fact, design is so important to instruction that Grassian and Kaplowitz (2009) dedicated an entire chapter to it in their important book titled *Information Literacy Instruction: Theory and Practice*. They write, “Librarians may not be trained in instructional or graphic design, yet often they must create a range of instructional materials and formats to support both in-person and remote learning for many ages and skills” (Grassian and Kaplowitz: 173). Their chapter integrates visual design into suggestions for instructional design, with a breakdown of how visual design should be adapted depending on the medium in which the instruction is delivered. They discuss the need for white space, the importance of color choices on academic performance, how to properly use graphics, and the effect of font choice.

Librarians often rely on class handouts to remind students of the more mechanical or factual information when the students go to do the actual research after the class. Even with few colors or images other than an occasional screenshot, clear organization, layout, use of white space, and font selection make an enormous difference in the educational effectiveness of these class handouts. Similar design principles are required in the creation of online tutorials as well, with the likelihood that more video, audio, and color will be necessary, as well as the ability to select an appropriate technology to create and deliver the tutorial to potential users.

Many academic libraries manage the college or university’s archives. These archives house relics and documents of the institution’s past to inform current students, administrators, as well as help alumni continue to connect with the institution. Many archives are making their collections more accessible by digitizing them, which is facilitated by having easy access to someone with an advanced knowledge of formatting and ethically managing digital images. Additionally, as one key purpose of an institutional archive is to help various constituents connect with the institution, graphic design skills allow the library to create attractive displays, publications, blogs, and materials for outreach events.

**The authors’ previous experiences**

The two authors of this chapter have each worked in graphic design departments in previous employment positions. Each author will introduce her former life in publishing and marketing and describe how the skills developed in those positions enhance their current careers as academic librarians. In the context of this chapter, Mary and Judith have very complementary experiences. While Mary only spent a year in a graphic design department and the skills she learned were more related to design software than design, the skills developed in that position have enabled many creative projects in her position as an instructional services librarian, though they bear little resemblance to a traditional idea of graphic design. In contrast, Judith is just beginning her career as an academic librarian, but had many years of experience as an art director...
and graphic designer. Her projects in libraries more closely resemble those of a professional graphic designer. Their combined experiences offer a unique perspective.

Mary J. Snyder Broussard

Shortly after obtaining her bachelor’s degree in French and German from Miami University of Ohio, Mary Broussard obtained a job as a copyeditor in a children’s craft supply company in the Chicago area. The primary duties of the position included checking accuracy, spelling, and grammar on product packaging, and creating project instructions. Furthermore, she translated all packaging and instructions into French for any products destined for Canada. As the main function of this position revolved around packaging, this position was housed in the graphic design department. Secondary duties included corresponding with relevant magazines to get the company’s products featured and posting images and project ideas on the company’s website.

While the position was not that of a graphic designer, she was surrounded by graphic designers and expected to learn basic skills in the popular graphic design software Adobe Photoshop (used to manipulate photographs) and Illustrator (used to create line drawings). Photoshop skills were particularly important for the craft project ideas displayed on the company website, as this involved not only creating attractive projects with craft foam, pom poms, and pipe cleaners, but also generating attractive photographs of the project, generating printable templates, and manipulating purchased stock photographs so that the company website showed children playing with new products. Inserting a company’s product into stock photography is a common practice for issues of ease and cost. The professional graphic designers that she worked with were busy working on packaging, so she had to quickly learn Photoshop well enough to make the images for the website believable.

During the time that Mary was in this position, she decided to attend library school. She took many experiences and skills from her 14 months in this position, but most tangible of these skills were those directly related to graphic design software, with some basic skills obtained in marketing, and website development. After completing her MLS degree at Indiana University, she began work as an instructional services librarian at Lycoming College, a small private residential institution in central Pennsylvania, where she has been for nearly eight years. At her library, there is a non-librarian employee who serves as production artist for official library marketing, including the popular READ posters of campus professors, and student groups. However, Mary has found that it is often critical for a librarian to directly create some graphics. This eliminates the need to always have to explain one’s vision to someone else. There have been many times in Mary’s experience that the graphics were too intertwined with technology or instructional design to be given to someone else.

From very early in her position at Lycoming College, Mary took advantage of Banned Books Week to create an outreach event around her love of young adult literature. It began as a display the first year with a poster and an offering of frequently challenged books from the library’s collections and quickly developed into a series of trivia games that invite student, staff, and faculty participation. Each of these Banned Books Week events has involved graphics skills, either in the form of
advertising or to create the trivia games. In 2009, Mary used Adobe Illustrator to create eleven pictograms representing well-known, frequently challenged book titles (see Figure 13.1). She posted the pictograms around campus and asked students and faculty to submit completed game sheets to be entered into a raffle for a local gift certificate. In 2010, she used Illustrator again to recreate frequently challenged book covers stripped of all text. These were posted around the library and Lycoming community members were invited to submit their title guesses to be entered into a raffle. There was a significant amount of talk about these trivia programs, but only a few students took the time to submit game sheets. Participation increased enormously as the annual trivia games moved to the library’s Facebook page with instructions to submit individual guesses for each book title by email. The increase in the participation and visibility of this particular outreach event has meant that each subsequent year Facebook has been used with similar results in attracting large numbers of participants. The trivia games have evolved over the years, but they have always used design software in their creation.

One of Mary’s primary duties is to maintain the library’s extensive website. At Lycoming College, the library uses the college’s website template which was created by professional designers and web developers on staff. The library director and she have worked with the campus web developer to make minor accommodations to the campus template and guidelines to best meet the needs of library users. This allows the library to provide an attractive and sophisticated page that has a consistent feel with other college pages. Within the web theme, Mary uses images to portray the library as a friendly place and promote special events. She also formats logos and images to be inserted into database headers as that customization feature becomes more prevalent among database vendors.

Mary has used graphics software and basic visual design for a number of instructional purposes. She teaches approximately 50 information literacy classes per academic year. Layout, contrast, and hierarchy are important factors she considers when creating handouts for each of these classes. Images such as screenshots are used when they are likely to be helpful, and they often require well-positioned, succinct, and uncluttered labels.

One of Mary’s favorite examples of graphics skills transferring to academic librarianship is the game-based learning it has enabled at Lycoming College. In 2013, the Higher Education Horizon Report cited games and gamification as one of the upcoming technology trends that will change education (Johnson et al., 2013). Gamification has the potential to help learners embrace the assigned learning goals and absorb more information because students are enjoying the learning process. Building educational games requires skills in many areas including understanding of basic game mechanics, good pedagogy, relevant technology, and appealing graphics. This is ideally done by a team. However, effective educational games are often built for specific, local learning goals, and therefore often do not have significant resources allocated to them. Mary has worked to make effective, small-scale games where she plays the primary part in all aspects of game development, including the graphic design. She has worked with colleagues to create a number of online, real-world, and hybrid games, each of which involved using design software such as Adobe Illustrator, Photoshop, Dreamweaver, and Flash.
Figure 13.1(a)–(b) Two examples of line drawings created in Adobe Illustrator for the annual Banned Books Week trivia contest. (a) A pictogram representing *I Know Why the Caged Bird Sings* by Maya Angelou. (b) Representation of the cover of *Twilight* by Stephanie Meyer. Images designed by Mary J. Snyder Broussard.
In an effort to redesign the freshman orientation event to be more engaging for students, it was turned into a treasure hunt game where students completed educational activities to find letters and complete a ransom note that revealed the location of the “missing” unofficial campus mascot (Gregory & Broussard, 2011). One of the learning objectives was for students to simply acknowledge the existence of three locations; the vending machines, the Leisure Reading Collection, and the Academic Resource Center (important, but not administratively part of the library). For these three locations, we borrowed a brilliant low-tech augmented reality game idea from Burke, Kreyche, and Maharas’s “Ran Some Ransom” game developed for the 2009 Come Out and Play festival. In “Ran Some Ransom” players lined up transparencies to views in Times Square. The transparencies outlined what existed in reality, with additional circles highlighting letters to be used in the ransom note. To re-create this idea of low-tech augmented reality for the freshman library orientation, Mary imported a digital picture of each of the three library locations into Adobe Illustrator, traced the photograph, and highlighted a letter to be used for the ransom note (see Figure 13.2 below).

**Figure 13.2** A photograph of Lycoming College’s Academic Resource Center (ARC) sign next to a transparency outline. When players look through the transparency and line-up the outlines to the poster, the C becomes highlighted as Letter 8 for their ransom note. Photograph and line art designed by Mary J. Snyder Broussard.
Mary created *Goblin Threat*, an online game to teach students how to identify and avoid plagiarism, in 2009 using Adobe Flash (Broussard & Oberlin, 2011). While she had not learned Flash as a copy editor, her knowledge of Adobe Illustrator greatly facilitated the learning curve in drawing figures in Flash. When the graphics and programming were completed, Mary worked with a colleague to write the questions. The resulting project’s success has been enormous. Not only was it very well-received on Lycoming’s campus, she has received over 70 requests to use or link to the game from other schools, colleges, and universities around the world and has identified over 40 additional institutions that link to the game from their website. Due to this high volume of external traffic to *Goblin Threat*, it is one of the most visited pages on the entire campus website. This is an enormous return on the investment of time to develop the game.

While Mary’s time as a copy editor was relatively short, and it would be a far stretch to consider her a *graphic* designer, she is a web designer, an instructional designer, and a game designer. She continues to use Adobe Photoshop, Illustrator, and Dreamweaver on a regular basis in her duties as an academic librarian. Knowledge of this software has enabled her to learn other software such as Adobe Flash and HTML5 to build online games and tutorials. Furthermore, she learned a great deal about the design and editing process, which have further inspired and enabled her creative outreach and instructional projects.

**Judith Schwartz**

Judith is working on combining her career skills as information professional, and visual-design communicator. Prior to her library career, she worked as an art director and design manager on numerous textbook projects at various design studios for major educational publishers in the K-12, ESL, scholarly and reference, and university press markets. With a BFA from The Cooper Union School of Art and an MA in Advertising and Communication Design from Syracuse University’s College of Visual and Performing Arts, Judith has designed book interiors and covers, logos, and marketing materials for clients including McGraw-Hill, St. Martin’s Press, Scholastic, Highlights, Harcourt, Pearson, and Oxford University Press.

Her career has included collaboration with editors, authors, designers, illustrators, photographers, photo researchers, and marketing teams to develop marketable book products. Besides designing, doing image manipulation, photo research, and assigning projects to illustrators and photographers, she has years of experience managing projects and staff, as well as working with outside vendors and printers. At various times throughout her career she has been an adjunct professor teaching graphic design-related courses in a classroom setting at Long Island University’s Southampton Campus and online at The Art Institute of Pittsburgh, Online Division. Judith is adept with graphics software and uses the Adobe Creative Suite.

Due to the changing climate in the publishing industry, outsourcing, and other factors, she became interested in transitioning to a career in digital archiving. She
decided to go to library school and graduated from the Palmer School, Long Island University C.W. Post in the winter of 2012 with an MSLIS and Certificate of Archives and Records Management. While she entered library school leaning towards a digital archives career, she became increasingly interested in academic librarianship. She began interning at Hunter College Library/CUNY as a reference and instruction librarian, and became an adjunct at Hunter upon receiving her degree. She was able to try out many of her new skills and felt very well suited to working on archival projects, teaching, and online and face-to-face research assistance with students.

Judith thought her graphic design career was going to be very separate from her new career direction and was planning on maintaining two separate identities, but to her surprise, it has evolved into one career. She has had interesting short-term positions and internships that have enabled her to utilize many of her prior career skills in her current full-time position as a librarian. In July 2013, Judith was hired as a librarian at Medgar Evers College, City University of New York. Medgar Evers is an urban campus in Brooklyn with an entirely commuter student population. In addition to teaching information literacy one-shot classes and her daily reference desk duties, Judith supervises interlibrary loan. Graphic design quickly became a regular part of her job responsibilities as well.

It was not long after Judith began working at Medgar Evers College that she was asked to design a set of bookmarks to promote the library’s services while the library on campus was being renovated (see Figure 13.3). The purpose was to attract students to the library’s temporary location and the slogan was “Alive at the Library”. The library administration wanted four bookmarks for the departments including “Reference and Information Literacy”, “Instructional Media Services”, “Circulations and Access Services”, and the “Archives”, and “Special Collections”, Judith’s goal was to make the bookmarks fun, colorful, and inviting. She chose a bright color palette for the vertical sidebars so each department would have its own color identity. She sought out images from the library archives that were relevant to the school’s mission of civil rights and social justice. She was also able to download royalty-free art that she was able to later manipulate in Adobe Illustrator.

The bookmarks have been distributed at the circulation desk, the reference desk, in instruction classes, and at library exhibits. Additionally, another college office distributes the bookmarks to potential students at area high schools. The initial printing of bookmarks proved to be so successful, they have undergone a second printing. Judith and the library have received many positive comments about the bookmarks from students, faculty, and other campus offices. They were such a promotional success that they evolved into her creating additional projects including a media screen slide to advertise library services on monitor displays around campus and a large tri-fold table display board used as a backdrop at events when promoting the library (see Figure 13.4).

In December of 2013, the Medgar Evers College Library launched a new outreach event called Holiday Extravaganza, which included music, art and photography, break-dancing, and poetry created by the talented library staff. Judith designed the colorful program and performance agenda that would be handed out at the concert and a corresponding media screen slide that would be projected on the monitor displays around campus. As Judith was also showing some of her own photo collage
Figure 13.3 Bookmarks: promote the library’s services and direct students to a temporary location. Bookmarks designed by Judith Schwartz.

Figure 13.4 Media Screen Slide: promotes the library’s services on monitor displays around campus. Slide designed by Judith Schwartz.
artwork at the event, she decided to carry some of the themes over into the program design (see Figure 13.5). She also photographed the library staff for the program and manipulated images in Photoshop to fit the project specifications. The Holiday Extravaganza event was a major collaborative effort and a great way for the library staff to work as a team. While the turnout for the event was small, it really showed the library staff was “Alive at the Library” in the temporary library space. There was a great deal of enthusiasm generated by the event and this will surely be an annual occurrence for years to come.

Shortly afterwards, the archivist at Medgar Evers College was interested in producing a publication of Library Resources for Black History Month and asked Judith to participate in the design. The main content of the pamphlet consisted of a bibliography of books that could be found in the library’s Special Collections, Caribbean Collection, and eBook Collection. In order to maintain the library brand, Judith designed the pamphlets to complement the Archives and Special Collections’ bookmark so it looked like it was part of a series (see Figure 13.6). The pamphlets were displayed at the reference and circulation desk and were brought to several outreach events during Black History Month.

Judith’s initial interest in archives led to several interesting archival projects. While she was in library school, she volunteered and later became a paid contractor on a project as an archival photo and film researcher for a documentary related to housing
rights activism on the lower east side of New York City. Her job responsibilities included locating photos and film footage in online digital photo repositories in addition to research at various historical archives. Excellent data management and organization skills were essential, as she needed to keep track of where images originated, box numbers and folders, online repositories, and image banks. She managed and conducted the tedious photo review meeting process with the other participants. Copyright issues and permissions were also addressed. In addition to the documentary, Judith worked on several digitizing projects at Hunter College’s Archives and Special Collections. She scanned and digitized deteriorating scrapbooks of clippings and images that entailed detailed retouching, repairing, and piecing images together in Photoshop, and then created PDF files.

Having established a solid career in the publishing field, Judith is a true graphic designer and artist. Her extensive experience with printers has enabled her to work with the campus print shop and to overcome numerous technical issues that arose in creating a quality product for her library. Her projects and the processes to develop them more closely resemble those of a professional design firm, allowing the library to project a very professional and sophisticated image in their marketing materials.

Abstract skills

The past experiences of the authors have provided each with advanced visual literacy skills. The specific projects described in this chapter show how these skills have benefited their respective libraries. Yet there are many other related skills gained from working in the field of graphic design that adapt well to library work. This section will
discuss those skills, and how they can facilitate one’s preparation to become an academic librarian and assist users in unique ways.

Organization, in all of its manifestations, is incredibly important in the marketing and publication worlds. Everyone must work together to create an excellent end product that is visually pleasing, easy to read, editorially correct, and delivered on time. This means that designers must be organized, attentive to details, and able to manage their time well. Organization is the foundation of libraries. Resources should be stored in an extremely systematized manner, and finding systems should be built to work within that structure to enable users to efficiently locate relevant resources. Librarians need a solid understanding and appreciation for the organization of library systems in order to meet the mission of the library.

A key part of this organized environment is good time management. It is crucial to create deadlines and keep to the schedule. However, because there are many parties involved in the process, it is important to clearly communicate this schedule with everyone involved. Perhaps one of the more challenging aspects of doing graphic design in the library environment is that academic libraries are less deadline-driven and also most librarians and administrators are not aware of the time the creative process requires. Good communication is particularly important to help them set realistic expectations in regard to a schedule that works for everyone.

As a copy editor in a graphic design department, it was Mary’s primary responsibility to pay close attention to details. On the packaging, the image, all words, and product number all needed to correspond to the item contained within. Spelling and grammar also had to be perfect. Many aspects of the packaging needed to be carefully checked during multiple rounds of edits. Sending faulty packaging art to the manufacturers was expensive and time consuming to correct. It needed to be accurate when sent. This attention to detail is important to libraries as well. Catalogers and indexers must be precise in their organization if patrons and reference librarians are to be able to find the items when needed. Marketing materials need to be attractive and editorially correct in order to be effective. Finally, mistakes in computer code may render parts of the library’s website or a tutorial unusable.

A final important aspect of organization is good file management. It is important for a department to establish file-naming conventions, organize files so they are findable later, and frequently back-up files. Designers maintain the PSD (Photoshop Document) layered files so they can easily modify them if needed, though these must be converted to other file types such as high-resolution JPEGs or PDFs for printing or low-resolution JPEGs for uploading on a website. As multiple files are created for a single project, some of which may require special fonts, all files should then be properly stored at the conclusion of the project. In a library, organized file management allows for items to be easily found by various members of the staff for editing, reuse, or upgrading to new technology.

In addition to organizational skills, collaboration is also an important skill for designers. Throughout Judith’s graphic design career, managing and designing textbooks was an extremely collaborative process. She participated in group concept meetings with authors, editors, and designers, laying out books and deciding what
images and text would fall on each page, and assigned photo specs for historical images so that researchers could then acquire the images from stock photography agencies, museums, and archives. She was also a photo researcher on several social studies book projects. Mary worked closely with graphic designers, members of the company’s marketing team, magazine editors, and translators. There are so many special skills required in marketing and publication that collaboration and good communication are crucial in working towards a quality end product.

Libraries are also collaborative environments. Librarians in many areas of specialization work together as well as with paraprofessionals and student workers to provide quality collections, and services. Librarians also work with vendors to ensure electronic tools are working properly, and become more useful to the end-user over time. They collaborate with faculty to provide instruction, with patrons to meet their individual information needs, and with various student groups and other organizations on campuses to market their services and generally participate in the mission of the larger institution. Archivists often work with local historians and alumni to collect artifacts that represent the institution’s history. These are just a few examples of the many ways librarians work collaboratively to meet the community’s needs.

Conclusion

The need for visually literate professionals in academic libraries is twofold. A librarian with advanced knowledge in the area of image ethics and creation can better support students and faculty in an academic environment that is using an increasing number of pictures and photographs. Additionally, libraries have many design needs, particularly in the areas of web development, marketing, instruction, and archives. While many librarians develop a level of proficiency in these areas, having at least one librarian on staff with additional skills and training in design can be quite valuable.

Mary and Judith are creators and designers in addition to librarians. They love the collaborative nature of librarianship that offers the chance to work closely with students, faculty, and staff in other departments. They also love that academic librarianship offers so many creative outlets, which provide a great deal of personal satisfaction. At the same time, academic libraries have an important institutional need for in-house design, and software skills in many areas. This chapter shows a number of examples where their design skills have met a need in their respective libraries, and there were many more examples that could have been included. There is definitely a place for innovative, visually literate librarians who can combine a knowledge and dedication to the philosophies of academic librarianship with various forms of design skills.
References


Chapter 4 – Visual literacy meets information literacy by Mary J. Snyder Broussard, Judith Schwartz

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Science information literacy and the role of academic librarians

Have you ever noticed, when you teach, that the moment you start sharing a personal story with your students, they instantly snap to attention? You understand the value of stories. But some teachers don’t insert many stories into their lessons, because they’re worried that they don’t have gripping stories to tell, or that they aren’t good story tellers. So maybe it’s worth identifying which kinds of stories are effective in making ideas stick. The answer is this: virtually any kind.

*Chip Heath & Dan Heath (Made to Stick: Why Some Ideas Survive and Others Die, 2010)*

### 6.1 Is there a future for information literacy instruction?

With the number of reference questions decreasing, most journals being available online, and database interfaces becoming more user-friendly, what is left for subject/liaison librarians to do? As information, research, and education are becoming increasingly digital, academic libraries are forced to redefine their role in supporting education and research. Teaching information literacy is a major responsibility for subject/liaison librarians, but advances in information retrieval systems, such as improved natural language searching and Semantic Web, could change their role in this area. This new environment is particularly challenging for librarians who were trained to provide traditional library services.

A Delphi study based on a survey of 13 information literacy experts looked at the possible changes in information literacy and the role of librarians in it in the next ten years (Saunders, 2009). The study developed three possible scenarios for the future of library instruction services and tried to answer the following questions:

How prevalent will information literacy programs be within the higher education curriculum? Will academic librarians and library organizations play a significant role in the instruction and assessment of information literacy skills? If so, in what area(s) will they concentrate? Lastly, will their role be diminished as teaching faculty take on more of the responsibility for integrating this instruction into their own curricula?

The first scenario adhered to the “status quo,” in which the situation remains as it is now. According to the second scenario, teaching faculty will take over instruction and assessment of information literacy, a development that will leave librarians marginalized. The third scenario envisioned a close collaboration between faculty
and librarians in sharing information-literacy responsibilities. Most respondents to this survey showed optimism about the future of information literacy in academia and believed that librarians will continue to have a role to play through collaboration with faculty. The possibility that librarians could be replaced under certain circumstances has not been excluded, though, mainly because the improved and more intuitive information retrieval systems could make learning many information literacy skills unnecessary.

Departments have unique cultures, but there is also a specific culture in every university. An article discussed the importance and the difficulty of creating “a pervasively collaborative culture required by information literacy programs” and recognized that organizational culture plays a role in “campus readiness for information literacy” (Bennett, 2007). Another article suggested that librarians should avoid sticking to “a library-centric program and set an information literacy path that is relevant and valuable to course instructors and is aligned with the educational goals and mission of their institutions” (Brasley, 2008). It also described a possible framework for collaborations between librarians and teaching faculty that could lead to successful information literacy programs. Establishing partnerships between librarians and faculty, embedding librarians in academic units (Olivares, 2010), and providing online instruction (McMillen and Fabbi, 2010; York and Vance, 2009) will allow librarians to continue to play an important role in information literacy.

As suggested by Travis, in order to achieve integration of information literacy into the university curriculum, librarians and faculty need to investigate theories of change. He examined the change agency theory as a tool and a process for integrating information literacy into the general education curriculum (Travis, 2008).

The major obstacles for librarians to overcome in preserving their dominant role on the information literacy front would be faculty attitudes, lack of subject expertise, lack of technical skills, and a constantly changing dynamic environment that requires reskilling and lifelong learning (Brewerton, 2012). Librarians need to prove that their contribution to education is valuable. The number of instruction sessions is not a realistic measure of student learning, and librarians are still struggling to find a better way for assessing the impact of their efforts. By demonstrating improvement in student learning as a direct result from their instruction, librarians would be better able to justify their instructional programs.

6.2 The many faces of information literacy

The lack of consensus on how to define information literacy is at the root of the problems confronting librarians. Discipline and organizational cultures play a role in how information literacy is understood and valued (Saunders, 2009). In the future, teaching how to search and access information, which is the currently predominant model for library instruction, will become less important. If information literacy is to survive as a concept, it would need to include areas that until now either have not been supported by librarians or are the result of recent developments
in technology, research, and scientific publishing. Moving away from teaching information retrieval skills in favor of providing training on managing scientific information and research data will be a great opportunity for librarians to continue to be important players in the field of information literacy. Incorporating data literacy, bibliographic management, scientific writing, and ethics of scientific communication under the umbrella of information literacy will allow librarians to find new important roles in supporting education and research in their organizations. The next sections of this chapter show how bibliographic management programs were successfully integrated in information literacy programs. The different formats (face-to-face sessions and online tutorials) and tools (LibGuides and SurveyMonkey) were used to make the teaching of information literacy and assessment of student learning more efficient.

6.3 Managing citations

Bibliographic management tools have been widely used by researchers and students to import, store, organize, and manage references that they can later use when writing research papers, theses, dissertations, journal articles, and other publications. As shown in the next sections, incorporating them into information literacy classes was very beneficial to students.

6.3.1 What bibliographic management programs allow us to do

- Easy storage of references found online
- Discovery of new articles and resources
- Automated article recommendations
- Sharing of references with peers
- Finding out who’s reading what you’re reading
- Storing and searching of PDFs
- Capturing references
- Inserting citations from an individual’s library into a paper
- Viewing from anywhere
- Viewing saved references, along with the PDFs, on web, desktop, and mobile applications
- Taking notes and annotating articles in your library
- Automatic extraction of metadata from PDF papers
- Back-up and synchronization across multiple computers and with an online account
- PDF viewer with sticky notes, text highlighting, and full-screen reading
- Full-text search across papers
- Smart filtering, tagging, and automatic PDF file renaming
- Shared groups to collaboratively tag and annotate research papers
- Public groups to share reading lists
- Social networking features
- Usage-based readership statistics about papers, authors, and publications
- Smartphone apps
- Inserting citations from your library in a document you are writing
6.3.2 Most popular bibliographic management programs

The number of reference management tools is growing, and in order for users to decide which tool is best for them, they need to take into consideration many factors. Many websites and articles provide technical specifications and comparisons for these programs that help users choose the best tool for their specific needs (Duarte-Garcia, 2007; Fenner et al., 2014; McKinney, 2013; Zhang, 2012). Sometimes, one tool can be used for one purpose and another one for a different purpose. Quite often, choosing a bibliographic management tool is often a matter of personal preference.

Some of the most popular bibliographic management programs are listed below:

- CiteULike (www.citeulike.org)
- Colwiz (www.colwiz.com)
- EndNote Online (www.myendnoteweb.com)
- EndNote Desktop (www.endnote.com)
- Mendeley (www.mendeley.com)
- Papers (www.papersapp.com)
- ReadCube (www.readcube.com)
- RefWorks (www.refworks.com)
- Zotero (www.zotero.org)

EndNote, Mendeley, and Zotero are the most widely used bibliographic management programs in academic institutions, and they are discussed in more detail below.

6.3.2.1 EndNote (Thomson Reuters)

www.endnote.com

EndNote Desktop is a commercial reference management software package used to manage bibliographies and references when writing articles, books, theses, and other documents.

www.myendnoteweb.com

EndNote Online (previously, EndNote Web) is a free web version of EndNote (Duarte-Garcia, 2007; McKinney, 2013; Thomson Reuters, 2014; Zhang, 2012). Users can synchronize their EndNote Online account with the desktop version.

6.3.2.2 Mendeley (Elsevier, Inc.)

www.mendeley.com

Mendeley is a desktop and web program for managing and sharing research papers, discovering research data, and collaborating online (Habib, 2014; Haustein, 2014; Zhang, 2012). It combines Mendeley Desktop, a PDF and reference management application (available for Windows, Mac, and Linux), with Mendeley Web, an online network for researchers. Mendeley requires the user to store all data on its servers. Upon registration, Mendeley provides the user with 1000 MB of free space, which is upgradeable at a cost.
6.3.2.3 Zotero

www.zotero.org

Zotero is free, open-source software for managing bibliographic data and related research materials (e.g. PDFs). Its features include web browser integration (with Firefox), online syncing, and citing while writing. Zotero Standalone allows Zotero to be run as an independent program outside Firefox. You can add everything to Zotero—PDFs, images, videos, and snapshots of web pages.

6.3.3 Choosing a bibliographic management program

While it is important to know each tool’s strengths and weaknesses, this is not the only consideration that should influence your decision. There are many websites and articles comparing the functionalities of these tools (Fenner et al., 2014; Wikipedia, 2014; Zhang, 2012), but many of these comparisons look like the technical specifications for software or hardware that you can see when looking for a digital camera or another electronic product.

For those who use Web of Science or PubMed most of the time, EndNote is probably the best tool. It is made by Thomson Reuters, which also publishes Web of Science and is optimized to work with it. EndNote provides the greatest number of citation styles (more than 5000), but this could be an advantage over the other bibliographic management tools only if you need access to many different citation styles. EndNote or Mendeley will be better options than Zotero when using other browsers than Firefox, because Zotero works best as a Firefox extension. Those who want to use EndNote Desktop have to purchase the software and install it on their computers.

Mendeley is designed to be an academic networking tool as well as a platform-independent citation management tool that syncs your data across all your computers. It would be the best choice if sharing with a network of people and finding out what citations other people are compiling in their libraries is important to you. Students tend to prefer programs that look like the social media sites they are using, and the creators of bibliographic management tools are listening, adapting to the needs and preferences of these new users. Mendeley’s more “modern” interface emulates the experience they have with other social networking sites.

The more innovative feature of Mendeley, which distinguishes it from other bibliographic management programs, is that it aggregates and displays all users’ citations so that users can search or browse across the entire set of citations to find resources related to their research and then add them to their own citation library for further customization. Although Mendeley maintains users’ privacy, this feature may cause concerns among researchers involved in competitive areas of science who do not like their information-gathering habits to be monitored by a company.

Zotero and Mendeley allow the capture of a screenshot of a web page as well as other data about it. Syncing citations to an online Zotero account is easier and works more smoothly than syncing EndNote Desktop with EndNote Online. Zotero’s capture function works with more resources (databases, catalogs, and websites) than the import function of Mendeley or the capture feature of EndNote. Users can also import citations from sites such as Amazon and Flickr. Zotero makes it easy to create tags and write notes assigned to citations.
Very often, people choose a particular bibliographic management tool because they find it easy to use. As discussed in an article, there are also generational preferences with regard to which programs people are choosing (Hull et al., 2008).

### 6.4 Designing information literacy instruction

The introduction of LibGuides by Springshare (www.springshare.com) in the last few years has allowed libraries to promote their information resources in a new way using multimedia and social networking tools. LibGuides are much more flexible to use than web pages controlled by rigid rules and other external (institutional) factors. For the last several years, I have been using LibGuides in teaching scientific information and bibliographic management tools (Baykoucheva, 2011). For every course in which I taught such classes, I prepared a page in a LibGuide (http://lib.guides.umd.edu/chemistryresources), in which individual course pages were listed under a tab called “Course materials.” Such pages were used by students to access all resources taught in class. The assignment for the class (SurveyMonkey was used for this), a detailed handout providing essential details about search strategies, and other class-related information were also posted on the LibGuide page.

Integrating bibliographic management programs in science literacy classes allows students to learn how to do two important things: (1) perform literature and chemical property searches efficiently and (2) use a bibliographic management program to store references and cite them while writing. Classes were held in undergraduate and graduate courses in chemistry, biochemistry, molecular biology, and nutrition, as well as in a Professional Writing Program and in several honors programs.

Figure 6.1 shows a LibGuide page (http://lib.guides.umd.edu/chem272) created for a large chemistry course (CHEM272) for nonmajors with 454 students, divided into 22 sections. Teaching assistants (TAs) were trained to teach the instruction sessions for each section and grade the online assignments that students had to complete. In one hour, in addition to learning how to search literature databases, students also acquired basic knowledge of how to import references from databases into EndNote and insert citations (Cite While You Write) from their EndNote libraries into documents they were writing. Besides learning how to find and filter literature, students explored several chemistry property databases, drew molecular structures, searched for chemical compounds that corresponded to these structures, and found chemical properties and reactions for these compounds.

EndNote was used in these classes only as an example of a bibliographic management program. Once they have learned how such a program works, students can decide whether to use it or choose another tool. Zotero, Mendeley, and other new tools are free and easy to use.

### 6.5 How do we know we are helping students learn?

Each student had to complete an online assignment in SurveyMonkey. The assignment was graded and the grade was part of the overall grade of the student for the course. All students submitted their assignments and were very successful in answering the questions. It was very important that attendance and assignment were mandatory, which made the information
literacy class part of the whole course. As many students have acknowledged, the assignment enforced what they had learned in class and enabled them to practice with the resources and the bibliographic management program on their own. The fact that the assignment was graded and that the grade was part of their overall grade for the course was very important, as this motivated students to do it and do it as well as they could. This has substantially increased the significance of the library instruction in the eyes of both students and faculty. Now, all instructors with whom I have collaborated in incorporating information literacy classes in their courses always ask me to include an assignment and to cover EndNote.

One of the questions in the assignment required students to rank five of the resources taught in class (#1 being the most useful one). These resources were EndNote, PubMed, Reaxys, SciFinder, and Web of Science. As Figure 6.2 shows, 142 students (31%) have ranked EndNote as the most useful resource; Reaxys was ranked as the most useful resource by 163 students (36%). These results show that students realized that a bibliographic management program is very useful to them. After the successful experiment with this 200-level course, we are looking into rolling out a similar information-literacy class in a freshman chemistry course with 800 students.
Students in a graduate chemistry course had to answer a similar question in their assignment. As Figure 6.3 shows, there were some differences in the preferences of students. While EndNote had similar ranking (33% of students selected it as the most useful resource), the scientific database that graduate students ranked as the most useful one was SciFinder, with 38% of students giving it this ranking. There were 456 students in the course, divided into 22 sections.

Students in a graduate chemistry course had to answer a similar question in their assignment. As Figure 6.3 shows, there were some differences in the preferences of students. While EndNote had similar ranking (33% of students selected it as the most useful resource), the scientific database that graduate students ranked as the most useful one was SciFinder, with 38% of students giving it this ranking.

The students in the undergraduate course chose Reaxys as the most useful resource. It is difficult to explain these differences, but it would be interesting to explore the reasons for them. It could be that the students have made these choices based on their immediate needs (e.g. other course assignments and what material their course was covering). It was interesting, though, to see how students perceived what they were taught and see them try to figure out which resources would benefit them most. It was not a surprise that students in a chemistry course ranked the chemistry databases SciFinder and Reaxys as the most important ones. What is really interesting is that they gave a bibliographic management program such a high ranking. This proves that bibliographic management should be an important component of information literacy and that students need to be exposed to these tools as early as possible.

6.5.1 What usage statistics tell us

The statistics provided by the LibGuide mentioned above show that the peaks in its usage coincided with the classes and assignments. As shown in Figure 6.4, the LibGuide was accessed 19,118 times in the year 2014. The two peaks of use (in April and September) coincided with classes that were taught in a large chemistry course (CHEM272) with 456 students, who had to access all resources through the
Figure 6.3 Ranking of resources by students in a graduate chemistry course (October 2014). EndNote was ranked as the #1 (most useful) resource by 33% of students and was second only to SciFinder in this respect.

Figure 6.4 Usage data for a LibGuide (http://lib.guides.umd.edu/chemistryresources) used by the author to teach scientific information and bibliographic management in chemistry and other courses at the University of Maryland College Park. As shown in the graph, the LibGuide was accessed 5546 times during the month of September 2014.
LibGuide. Particularly remarkable are the results for the month of September, when the LibGuide was used 5674 times. In the course of 12 months (from June 2013 to May 2014), the highest usage of the same LibGuide happened in October 2013 and April 2014 (Figure 6.5), which also coincided with classes and assignments. When the LibGuide stats were compared with the usage stats for SciFinder (Figure 6.6),
it was found that the times when the LibGuide was used most coincided with the highest usage of SciFinder, one of the databases students had to use in class and for their assignments.

Having statistics of this kind to present can benefit librarians who are trying to find more accurate metrics than the number of classes taught, to prove their value. Results like these could help them demonstrate that their teaching is having an impact on the use of library resources and, consequently, on the information literacy of students.

As Figure 6.4 shows, the LibGuide also provided information about which particular areas were most often used by students. In this particular case, the highest usage was registered for the course page of the large chemistry course (CHEM272), from which students accessed all databases, the assignment, and the handout, along with other materials posted for the course.

### 6.6 Assessing student learning

For many years, I have been using SurveyMonkey for online assignments in the courses I have taught. Having all assignments in SurveyMonkey has allowed me to keep hundreds of assignments from which I was able to reuse questions and go back and use the results for reports, papers, and adjustment of teaching strategy. I was also able to see the learning outcomes of the whole group of students, as well as the individual results. The assignments were graded, and the grades were included in the overall grade of the student for the whole course. The number of classes and their duration differed from course to course—from 50 minutes to three hours duration and from one class in a course to three classes in consecutive weeks. The assignments included from 10 questions (for undergraduate courses) to 20 questions (for graduate courses). Figures 6.7–6.10 show some examples of the questions and how the students, as a group, responded to them.

### 6.7 Instruction formats

There is a discussion among librarians about what formats would best suit students, instructors, and researchers in supporting information literacy. The main question that is asked is whether face-to-face (F2F), entirely online instruction, or a blended format (both F2F and online) would be the most productive and efficient. As the results from surveys in my classes have consistently shown, the format students most preferred was the F2F format, as they found it easier to follow instructions in class and liked to be able to ask questions. Attending these classes was mandatory, and having an assignment that was graded motivated students to learn as much as possible in class, so that they could later do the assignment.

In the assignment, students had to answer a question about the preferred format of information literacy classes. More than 65% preferred F2F instruction; around 30%
Figure 6.7 Screen capture from an assignment (in SurveyMonkey) for a chemistry course. Students had to say where references exported directly from databases are found in EndNote. The correct answer is “Unfiled.”

Figure 6.8 Screen capture from an assignment (in SurveyMonkey) that students in a chemistry course had to submit. There are two correct answers: “Browser toolbar” and “Word Plug-in.”
preferred blended instruction, and only a small percentage wanted completely online instruction. As shown in Figure 6.11, students in a chemistry course (CHEM277) for chemistry majors ranked the in-class presentation as most useful, followed by the online handout prepared for the class.

Responses from students in another course about the preferred format for information literacy instruction showed that face-to-face instruction was the preferred format (67%), followed by “face-to-face and online tutorial” (42%) (Figure 6.12). Only 4% of students preferred the online only format. The question was included in an assignment for a course (UNIV100, Integrated Life Sciences) in the University of Maryland College Park.

Figure 6.9 Assignment question about the difference between a research paper and a review paper. The correct answer is “Experimental/Materials section.”
in SciFinder, under “Substances,” click on “Substance Identifier” and enter the following CAS #: 462-08-8. Find the molecular structure of the compound with this CAS # and draw its structure in Reaxys (www.reaxys.com) (Hint: Click on “Structures and reactions” and select “Substances”). Double-click in the window and draw the structure exactly as it was shown in SciFinder. Perform the search. Which of the following properties WAS NOT listed among the Bioactivity /Ecotox properties of the first substance you have retrieved?

![Answer Choices](image)

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>genotoxic</td>
<td>0.00%</td>
</tr>
<tr>
<td>transmitter releasing</td>
<td>0.00%</td>
</tr>
<tr>
<td>HMG-CoA reductase; inhibition</td>
<td>91.30%</td>
</tr>
<tr>
<td>None of the above</td>
<td>8.70%</td>
</tr>
</tbody>
</table>

Figure 6.10 Students were asked to (1) search for a chemical compound in SciFinder, using its CAS number; (2) find the molecular structure of that compound and draw its structure in another database, Reaxys; (3) look at the bioactivity/ecotoxicity properties of the first retrieved compound; and (4) choose which of the properties listed under the question was not associated with this compound. The correct answer is “HMG-CoA reductase, inhibition of.”
Which of the listed parts of this class did you find most useful? Rank as #1 the most useful one.

Answered: 23 Skipped: 0

Presentation in class
Handout
Course web page
Assignment

Figure 6.11 Responses from students in a 200-level chemistry course for chemistry majors to a question about which component of the information literacy instruction they found most useful. The question was included in an assignment that students had to complete in February 2014.

What format would you prefer for this kind of instruction?

Answered: 24 Skipped: 0

Face-to-face instruction...
Online tutorial
Both face-to-face...

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face instruction (like this class)</td>
<td>66.67%</td>
</tr>
<tr>
<td>Online tutorial</td>
<td>4.17%</td>
</tr>
<tr>
<td>Both face-to-face session and online tutorial</td>
<td>41.67%</td>
</tr>
</tbody>
</table>

Total Respondents: 24

Figure 6.12 Responses from students about preferred format for information literacy instruction. The question was included in an assignment for a course (UNIV100, Integrated Life Sciences) in the University of Maryland College Park. Face-to-face instruction was the most preferred format (67%), followed by “face-to-face and online tutorial” (42%). Only 4% of students preferred online (only) format.
6.8 Other elements of information literacy

As the importance of research data is increasing, eScience has emerged as a new opportunity for academic libraries to support research and education in their institutions. Helping researchers manage their data and integrating data literacy in library instruction will be the main areas of engagement for librarians in the future (Qin and D’Ignazio, 2010). The advancement of data literacy will depend on identifying and developing core competencies and standards that can serve as a framework for its inclusion in libraries’ information literacy programs (Prado and Marzal, 2013; Vogt, 2013). The roles of librarians in supporting eScience, in general, and data literacy, in particular, is covered in more detail in Chapter 8.

Academic librarians now discuss in their information literacy classes other areas such as scientific communication, Open Access, new forms of publishing, ethics of scientific publishing, scientific impact, social networks, and altmetrics. These topics are covered in other chapters of this book.

All assignment examples are from chemistry courses taught at the University of Maryland College Park. Screen captures from assignments are reproduced with permission from SurveyMonkey.

6.9 Sample questions for assignments in science courses

1. Adding an asterisk (*) at the end of a word would allow you to retrieve:
   - More articles
   - Fewer articles
   - Specific articles

2. After performing a search in a database, which of the following actions will reduce the number of results? (Select all that apply.)
   - Selecting a range of publication year(s)
   - Adding additional keywords
   - Choosing a particular document type (e.g. review)
   - All of the above

3. Which of the following actions will allow you to expand your search?
   - Putting an asterisk (*) after a word
   - Using specific terms
   - Using broader terms
   - Using a larger number of keywords
   - All of the above
   - None of the above

4. Which of the features listed below is/are missing from a review article?
   - Cited references
   - Graphs
   - Experimental/Materials section
   - Conclusions
   - Tables
5. In PubMed, (1) click on the “Advanced” option; (2) type ENZYME INHIBITORS in the first box. (3) Select “MESH Major Topic” from the pull-down menu on the left of this box; (4) click on “Show index list” on the right of the box; (5) double-click on “Enzyme inhibitors.” (6) In the second box, type CHOLESTEROL; (7) from the pull-down menu on the left of this box, select “MESH Term.” (8) Click on “Show index list” on the right of the box; (9) double-click on “Cholesterol”; (10) perform the search and limit it by time period (Hint: select “Custom”) to the time period from 1/1/2009 to 12/31/2010. Select “Review” under “Article types.” How many documents were retrieved for this time period?
   - 111
   - 246
   - 18
   - 308
   - None of the above

6. In Web of Science, enter “aspirin and cancer” (no quotation marks) as a topic. In the box under “Refine Results,” type “treatment” and click on the magnifier on the right of the box; on the next screen, check the box next to “Oncology” under “Web of Science categories,” and click on “Refine.” Narrow down the results by publication year, from 2009 to 2012 (Hint: make the years chronological by changing “Record count” to “Alphabetical”). How many documents were retrieved for this time period? Enter the answer in the box.
   - 204
   - 15
   - 43
   - 120
   - None of the above

7. After performing a search in SciFinder, which of the following actions is important to perform to narrow down the number of results (select all that apply)?
   - Refine the list by publication year
   - Remove duplicates
   - Add additional keywords
   - Limit to a particular document type (e.g. review)
   - All of the above

8. Perform a search for properties of aspirin in SciFinder (Hint: Go to “Substance identifier”; then on the next screen, click on the aspirin CAS number.) What is the melting point (experimental) for aspirin (in degrees Celsius)?
   - 135
   - 138
   - 145
   - 164
   - None of the above

9. In SciFinder, perform a search on a topic (use “Explore References”) and type “enzyme inhibitors AND cholesterol” (without the quotation marks) in the search box. From the options you were presented with, which one would be best to choose?
   - References were found containing “enzyme inhibitors and cholesterol” as entered.
   - References were found containing both of the concepts “enzyme inhibitors” and “cholesterol.”
   - References were found containing either the concept “enzyme inhibitors” or the concept “cholesterol.”
   - References were found containing the concept “enzyme inhibitors.”
   - References were found containing the concept “cholesterol.”
10. In SciFinder, under “Substances,” click on “Substance Identifier” and enter the following CAS #: 462-08-8. Find the molecular structure of the compound with this CAS # and draw its structure in Reaxys (www.reaxys.com) (Hint: Click on “Substances, Names, Formulas” and select “Substances”). Double-click in the query editor window on the left of the screen and draw the structure exactly as it was shown in SciFinder. (If you have a problem opening the drawing window (it is Java-based), click on “Structure editor” at the bottom of this window and select “Dotmatics Elemental.”) After drawing the structure, click on “Transfer Query” and click on “Search.” Which of the following properties was not listed among the bioactivity properties of the first substance you have retrieved?
   - Genotoxic
   - Transmitter-releasing
   - HMG-CoA reductase, inhibition of
   - None of the above

11. In Reaxys, click on “Substances, Names & Formulas,” select “Substances,” and type the following CAS # in the appropriate box: 504-24-5. This CAS # corresponds to which of the following chemical compounds?
   - Cholesterol
   - Toluene
   - Arachidonic acid
   - 4-Aminopyridine
   - None of the above

12. Use the Advanced Search option in ChemSpider; check the box next to “Select by Properties.” Select “Molecular Formula” and enter the following empirical formula: C33H35FN2O5. To which of the following substances does this formula correspond to?
   - Lovastatin
   - Lisinopril
   - Crestor
   - Atorvastatin

13. In PubChem, find property information for 3-aminopyridine. Which of the following numbers corresponds to the molecular weight (in g/mol) of this compound as listed under “Computed Properties” in the “Chemical and Physical Properties” section?
   - 96.12908
   - 94.12356
   - 94.11454
   - 94.23901

14. Perform a search in Scopus using the following string of search terms: “reverse transcriptase and HIV and hepatitis B” (no quotation marks). Limit the results to the year 2010. Which source title (journal) has published the highest number of articles on this topic in this particular year?
   - The Journal of Immunology
   - AIDS
   - Antiviral Therapy
   - None of the above
15. Perform a search in Scopus using “hplc fatty acids” as search terms (without the quotation marks). How many review articles were published on this topic in the year 2009?
   - 83
   - 121
   - 51
   - 14
   - 8
   - None of the above

16. Which of the resources shown in class were most useful to you? The most useful would be “1.”
   - EndNote
   - PubMed
   - Reaxys
   - SciFinder
   - Scopus
   - Web of Science

17. Select from the list below the resources about which you have learned for the first time in this class.
   - PubChem
   - PubMed
   - SciFinder
   - Reaxys
   - Scopus
   - Web of Science

18. References imported directly from databases to EndNote Web will be placed in
   - Quick List
   - Unfiled
   - Trash
   - None of the above

19. Perform a search in Scopus using the following keywords: “plant physiology and drought” (no quotation marks). Refine your results by adding “fungal” as an additional topic. Limit your results to those published in the year 2010. How many articles were published in the “Journal of Plant Physiology” for that year?
   - 203
   - 16
   - 8
   - 37
   - None of the above

20. Perform a search in Agricola on the EBSCO platform. Type “plant physiology” in the first box and “drought” in the second box (no quotation marks). Refine your search to SCHOLARLY ARTICLES and to the time period 2002–2006. How many articles were published during this time period?
   - 402
   - 389
   - 206
   - 14
   - None of the above
21. If you could choose the format of this kind of instruction, which of the following options would you prefer?
   - Face-to-face instruction with online tutorials (like this class)
   - Online tutorial only

22. Did you find this class and the assignment useful and why? Was the assignment difficult to do and how long did it take you to do it?

References


Chapter 5 – Science information literacy and the role of academic librarians by Svetla Baykoucheva

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