



INFORMATION COMPETENCE AS BOOSTER
FOR PROSPECTIVE SCIENTISTS

2022



COMPARATIVE REPORT

TEACHING INFORMATION LITERACY IN A DIGITAL WORLD FOR FUTURE PROFESSIONALS

State of the art of strategies and
methodologies for STEM in Europe



BRAIN @ WORK is co-funded by the Erasmus + Program of the European Union.

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Project Nr. 2019-1-IT02-KA203-062829

CUP: B54I19001980006

<https://www.brainatworkproject.eu/>

Authors:

National Research Council (Italy): Ornella Russo, Stefania Marzocchi

Eurecat (Spain): Santi Fort, Laia Subirats, Laura Lopez

Riga Stradiņš University: Anda Rožukalne, Inga Znotiņa, Diāna Kalniņa

Smart Skills Center (Italy): Mario Rotta, Emy Praela

Universidade do Minho (Portugal): Dinis Carvalho, Rui Sousa, Daniela Castro Ramalho, Helena Macedo

Université de Liège (Belgium): Bernard Pochet, Mathieu Uyttendaele, Marjorie Bardiau

Graphic design:

National Research Council (Italy): Debora Mazza

Revisions:

Studio Acta

Thanks to the contribution of



Table of contents

Chapter 1: Information literacy for adults in the twenty-first century	2
1.1 Information literacy for adults in the twenty-first century	2
1.2 Information literacy in the work context	7
1.3 Information literacy for researchers	10
1.4 Conclusions	11
Chapter 2: Experiences of information literacy education for researchers in Europe	12
2.1 Information literacy education in Europe	12
2.2 Information literacy education for researchers in Belgium	13
2.3 Information literacy education for researchers in Italy	15
2.4 Information literacy education for researchers in Latvia	20
2.5 Information literacy education for researchers in Portugal	25
2.6 Information literacy education for researchers in Spain	27
2.7 Conclusions	28
Chapter 3: Perception and experiences in the use the technical-scientific information in research work...	30
3.1 Participants' profile	30
3.2 Perception of scientific and technical information	31
3.3 Critical experiences in the use of scientific and technical information	32
3.4 Learning information literacy	33
3.5 Conclusions	34
Chapter 4: Information literacy education for adult learning	37
4.1 Models for information literacy adult education	37
4.2 Framework and curriculum for information literacy education for adults	41
4.3 Learning strategies for adult information literacy education	43
4.4 Conclusions	43
Chapter 5: Bibliography	45
5.1 Introduction	45
5.2 Methodology	45
5.3 Selected references	47

Figures

Fig. 1 Relationship between information literacy and lifelong learning	7
Fig. 2 - Focus groups' results	36
Fig. 3 Information literacy: A review of literature by Kay Ahmadpour (2015).....	39
Fig. 4 R. Kay and K. Ahmadpour 5Ps framework	40

Tables

Tab. 1 Definitions of information literacy.....	4
Tab. 2 - Plan for implementation of the Mass Media Policy Guidelines of Latvia 2016–2020, Action 4..	22
Tab. 3 The four career stages outlined and defined in the European Commission's communication 'Towards a European Framework for Research Careers'	30
Tab. 4 - Inclusion Criteria	46

Glossary

ECTS	European Credit Transfer System
IL	Information Literacy
MIL	Media and Information Literacy
STEM	Science, Technology, Engineering and Mathematics
STI	Scientific and Technical Information

Chapter 1: Information literacy for adults in the twenty-first century

1.1 Information literacy for adults in the twenty-first century

The history and meaning of the concept of information literacy have been extensively analysed and reported in various sector studies to which we refer (Campbell, 2004; Owusu-Ansah, 2005; Chevillotte, 2005; Bawden, 2001). The concept of information competence is not unique either for the multiplicity of translations existing in different languages or the variety of meanings and nuances that the concept itself carries with it and which are often traced back to the polysemy of its two terms: ‘information’ and ‘literacy’.

A first significant ambiguity is given by the fact that the English expression *information literacy* refers to both the status (to be literate) and the process (to make someone become literate). This ambiguity increases when the scientific literature is analysed in this area because, as Basili clearly points out, this corpus of studies responds to at least three different perspectives of analysis, which often, however, remain implicit in sector studies (Basili, 2008):

- the disciplinary perspective, for which information literacy is understood as an information culture and therefore, as an area of study of the disciplines of books and documentation;
- the social and political perspective, for which information literacy represents an educational and political objective of public institutions;
- the cognitive perspective, for which information literacy represents a personal competence to be acquired and therefore, a set of skills, contents and values to be taught.

More than 40 years after the first definition of the term introduced by Zurkowsky (1974), the debate on information literacy continues to revolve around a series of key issues, well highlighted by Basili, which can be summarised as follows: the community promoting the problem of information literacy is mainly about the library subject. In the subjects of books and information, there is a wide consensus on the importance of information literacy, but there is still a lack of a universally accepted vision and definition of the concept. Outside the community of reference there is a lack of awareness of the issue and the difficulty in distinguishing between information literacy and the other competences with which it is interconnected (in particular the digital and technological one and that relating to media and communication). A large amount of specialised literature on the subject is available, however, an agreement is still needed to identify specific

concrete actions, agents and ways for the effective realisation and implementation of the objective.

To these considerations we can add that a multiplicity of courses, teaching materials and tutorials have been produced by the library community, but there is often a lack of strategies for evaluating the effectiveness of the interventions, the setting up of the materials and the possibility of systematic access to this set of resources.

For the purposes of this report, we limit ourselves to briefly recalling some elements to focus on the concept of information literacy in its key characteristics, with particular attention to the reflections of the last 20 years, which have defined an evolution of the term in response to the changes caused by the technological revolution and the new digital information ecosystem in which we are all immersed. The goal is not to carry out a detailed analysis of individual definitions and positions, but to offer a synthetic picture of the key aspects, even when it is subject to different opinions.

The table 1 shows the most quoted definitions in the scientific literature together with the most recent ones, reviewed by the professional communities, among those aimed at the target adult population.

The concept of information literacy, as reported in most recent definitions, refers in general to the ability to know how to use information effectively in the contexts of social, educational and professional life. The expression ‘knowing how to use effectively’ implies at least three different dimensions/nuances:

- the knowledge and skills that one must develop in order to identify, select and manage documents and information, but also to be able to synthesise, remix, share and communicate them to others;
- the ability to implement this knowledge and these skills in real life to address problems and activities related to information and documents in the contexts in which the individual acts as a citizen, student, worker and professional;
- the need to develop a critical approach to the amount of documents and sources that has become increasingly rich and complex with the emergence of the digital revolution and new mechanisms for the production and dissemination of content, including scientific content and information through the Internet.

Tab. 1 Definitions of information literacy

DEFINITION	CONTEXT	SOURCE
Information Literacy encompasses knowledge of one's information concerns and needs, and the ability to identify, locate, evaluate, organize and effectively create, use and communicate information to address issues or problems at hand; it is a prerequisite for participating effectively in the Information Society, and is part of the basic human right of life-long learning.	CITIZENSHIP; LIFELONG LEARNING	Unesco, The Prague declaration "Towards an information literate society", 2003
Information literacy comprises the competencies to recognize information needs and to locate, evaluate, apply and create information within cultural and social contexts.	CITIZENSHIP; LIFELONG LEARNING	Beacons of the Information Society: The Alexandria Proclamation on Information Literacy and Lifelong Learning, 2005
Information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning	UNIVERSITY	ACRL, Framework per la competenza informativa per gli studi universitari, 2015
Information literacy is the ability to think critically and make balanced judgements about any information we find and use. It empowers us as citizens to reach and express informed views and to engage fully with society. Information literacy incorporates a set of skills and abilities which everyone needs to undertake information-related tasks; for instance, how to discover, access, interpret, analyse, manage, create, communicate, store and share information.	CITIZENSHIP, UNIVERSITY, WORK, LIFELONG LEARNING	CILIP, Definition of Information Literacy, 2018
Media and information literacy is an interrelated set of competencies that help people to maximize advantages and minimize harm in the new information, digital and communication landscapes. Media and information literacy covers competencies that enable people to critically and effectively engage with information, other forms of content, the institutions that facilitate information and diverse types of content, and the discerning use of digital technologies. Capacities in these areas are indispensable for all citizens regardless of their ages or backgrounds.	CITIZENSHIP; LIFELONG LEARNING	Media and Information Literate Citizens: Think critically, Click Wisely (UNESCO Model Media and Information Literacy Curriculum for Educators and Learners, 2021).

Compared to the previous definitions, it is possible to underline three important shifts in meaning in the new approaches proposed in the recent documents:

- the shift from competence for study to competence for life
- the ambivalent link between information and digital literacy
- the link between information literacy and lifelong learning

a. The shift from competence for study to competence for life

It is clear that the most recent definitions do not consider information literacy as a capacity exclusively linked to the context of use of library resources and to the school and university context, in which it represents a transversal competence to be able to learn and produce new knowledge. On the other hand, it is associated more often with the different life contexts and the different roles that each one assumes (citizen, students, patient, administrator, adult in training, etc.). The UNESCO definition recognises it as a ‘fundamental right of citizens to be able to participate actively in the society of the 21st century’.

Although not everyone agrees with this statement, most studies show that this competence represents a fundamental tool of empowerment for all citizens, indispensable for being able to express informed points of view and to participate fully and actively in the contemporary knowledge society, and knowing how to critically orient oneself in the information ecosystem. In this sense, information literacy is part of the transversal skills that a student must acquire throughout the school career, as well as a competence between the skills for work and active citizenship.

Another clear element in these definitions is an idea of information literacy not only as a capacity for documentary investigation aimed at the production of new knowledge, but as a broader methodological capacity to know how to locate and effectively use documents and information, to cope with a series of activities strictly correlated with their use. This can be knowing how to constantly update oneself, knowing how to inform oneself, knowing how to make informed decisions, knowing how to solve problems, up to more sophisticated actions such as innovating and creating. In the sector literature there seems to be a broad consensus on the close proximity/correlation between information literacy and processes such as decision-making and problem-solving. However, often the meaning of this link is not further explored, in terms of learning objectives, contents and possible educational strategies (Basili, 2008).

b. The ambivalent link between information and digital literacy

The digital revolution has deeply changed the world of documents and information both in the mechanisms of production and dissemination of digital content and in the processes of research, selection and access to those same contents.

Christine Bruce notes how today information literacy is associated with information practices and critical thinking in the context of information and communication technologies (Bruce, 2002). This close and inextricable correlation between the digital environment, in the broadest sense of the term, and information competence, emerges even more clearly in the analysis of the literature conducted by Kay and Ahmadpour, who highlight both the close correlation between information and digital literacy, and the possibility of interpreting one as a component of the other and vice versa. Additionally, this can depend on whether you look at the world of

documents in its complexity and diversity, in terms of formats, functions and uses (in this approach, digital competence is an aspect of information literacy) or the digital ecosystem in which we are immersed, of which information constitutes a subset (in this second approach, information competence is an aspect of digital competence) (Kay & Ahmadpour, 2018).

The first approach is that adopted by the European Commission in the elaboration of the DigComp theoretical model from which the reference framework for citizens' digital skills was born. Information literacy is meant as the ability to search, evaluate and manage data, information and digital content, and is considered one of the five areas of competence to be acquired, together with the skills and knowledge related to online communication and collaboration, digital content creation, security and problem-solving (Ferrari et al., 2013).

The second approach is adopted by the new models and frameworks on information literacy published or updated in the last 15 years, which have raised the question of whether and how information literacy changes when going online, albeit from different points of view. For example, the metaliteracy framework explicitly places the need to rethink information literacy, in relation to Internet participatory and collaborative potential, and the possibility of producing, sharing and disseminating knowledge in online communities (Mackey & Jacobson, 2017).

As Kay and Ahmadpour underline, perhaps we should start talking about a single construct called information and digital literacy (Kay & Ahmadpour, 2018). A step in this direction was taken by the programme of actions proposed by UNESCO for Media Information Literacy (MIL) to contrast the phenomena of disinformation and misinformation that are increasingly emerging in the processes of production and access to online content.

c. The link between information literacy and lifelong learning

Lifelong learning is defined by the European Commission as the set of 'learning activities undertaken during life, with the aim of improving one's knowledge, skills, competences, within a civic, social and working perspective' (Classification of Learning Activities – Manual – 2016 Edition s.d.).

As highlighted in several recently published reports, the changes that the labour market has gone through and will go through more and more rapidly in the coming years will require workers to frequently change professional profiles and for this reason, constantly update and extend their skills autonomously and continuously, to remain employable or to achieve satisfactory and rewarding careers (Directorate-General for Employment, 2018).

Learning to learn for a lifetime, or becoming able to learn independently, implies, among others, the ability to find and use information, content and documents effectively. The link between information literacy and the ability to learn throughout the life span is made explicit both in the most recent definitions and the guidelines that International Federation of Library Associations and Institutions (IFLA) has dedicated to this topic (Lau, 2006).

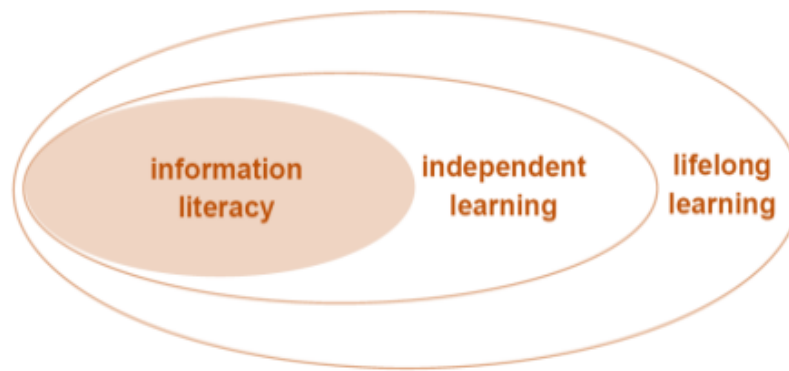


Fig. 1 Relationship between information literacy and lifelong learning

Information literacy is self-directed and self-motivated, and people can improve their skills in critical research and autonomous learning. For this reason, it is closely related to the possibility of learning throughout the life span, which is also one of the key objectives envisaged by the UN Agenda for Sustainable Development (Andretta, 2004; Hogasawara & Candy, 2002).

In the current knowledge society, the real digital divide is represented by the cognitive rather than the technological gap. The exponential increase of available information and the speed of change to access it means that discrimination between individuals today no longer resides only in technical and economic difficulties, limiting access to the Internet. Above all, the issue is knowing how to recognise the most effective strategies and tools to respond to information needs, in terms of time, quality of results, compliance in terms of completeness and costs.

1.2 Information literacy in the work context

Although the scientific literature on information literacy represents a substantial and extremely varied corpus of studies, there are few works dedicated to training competence for work and adult lifelong learning, and several authors in this area agree in considering it an emerging research area, which requires further studies and investigations that can guide theory and practice (Lloyd, 2010; Lloyd & Williamson, 2008; Kirton & Barham, 2005).

The link between informational literacy and work is proposed by Zurkwosky (1974) in the first proposed definition of the term and is then recalled and strengthened in the Prague Declaration and in the Proclamation of Alexandria.

The studies conducted by the Australian researcher Christine Bruce were pioneering. In the 1990s she carried out a variety of investigations in different work contexts, developing a conceptual model of analysis based on the vision and relationship that each person builds with documents and information and which also influences our behaviours and practices (Bruce, 1997).

Recently, the interest in this area has greatly increased and there is a general consensus in sector studies on the basic idea that information competence is and should also be a specific attribute of the workforce and employability. As a key strategic competence, it represents an important competitive advantage, and an educational urgency, which must however be the subject of specific analyses, since it is not possible to transfer what has been learned and experienced in the academic field to different working contexts (Perrault, 2007; Cheuck, 2002, 2008; Lloyd, 2003).

For the purposes of this report, some synthesis works are considered here, which allow us to contextualise the topic, beyond the multiplicity of approaches and different disciplinary fields, which characterise the reference scientific literature.

In 2014, Williams, Cooper and Wavell in collaboration with the InformAll programme conducted research on the relevance of information literacy in the workplace, which resulted in an annotated bibliography on the subject. Based on an analysis of the literature of the previous 15 years, the research tried to answer two crucial questions:

- How it is described and what are the key skills of information literacy in the workplace;
- If there is evidence of the value or impact of informational literacy in the job.

Compared to the first question, in general it emerges that the reference literature explores and deepens the topic from different points of view, but in most cases the authors do not give a specific definition of the information literacy for the job. Many authors report more generic definitions taken from other contexts, mostly the academic one. AnneMarie Lloyd is the author who offered reflections specifically related to the world of work. The conceptual definitions she proposed underline the importance of developing a varied and complex relationship with the multiplicity of documents and resources and the importance of the social and intersubjective dimension that characterises the world of work, compared to other contexts. Specifically, Lloyd states that information literacy is a way of knowing the information universe and that a person with information literacy must have a deep awareness and agility in orienting themselves in the information environment, which enriches and empowers the person, with its social, procedural and physical dimensions. According to this approach, the relational, social and cultural dimensions are key. Information literacy is equivalent to knowing the sources of information within an environment and to understanding how these sources and the activities used to access them are constructed through speech. Information literacy is a relationship-based competence and is created through the connections that exist between people, artefacts, texts and experiences, which allow individuals to develop subjective and intersubjective positions (Lloyd, 2011, 2004).

A definition more specifically aimed at the business context is that offered by Sen and Taylor (2007), who define corporate information literacy as a company or organisation that has information management skills and systems. This means collecting, analysing and using appropriate information effectively to support business strategies and operations. Other authors,

while not reporting a specific definition, describe it as a competence referring to the ability to locate, access and apply information in order to solve work-related challenges and the ability to use a variety of information resources appropriate to the tasks to be performed (Kirton & Barham, 2005; Inskip, 2014; Klusek & Bronstein, 2006). According to the definition of the Association of American libraries (ALA), an information literate worker is one who knows how to learn, knows how knowledge is organised, can locate information and use information in such a way that others can learn from them.

The analysis underlines that, despite the absence of a specific definition of information literacy for the job, all the authors still tend to emphasise the importance of the following three aspects:

- the social, informal and contextualised processing of information;
- the transformation of information into knowledge;
- the creation, packaging and organisation of information.

In conclusion, it can be said that *information literacy* is not generally recognised in the workplace, while the expression ‘effective use of information’ is preferred by some authors.

Beyond the definitions, it is interesting to analyse the skills and characteristics that information literacy assumes in the workplace with respect to the educational context. The key aspects are the following:

- the focus is more on the use of information than on the formal skills of research and retrieval of information;
- the source of information is different, more importance is given to people as sources of information than to the library’s sources;
- the skills-based approach is considered inappropriate for the job;
- models of information literacy are criticised for the equal importance attributed to all areas of competence that are not activated in work;
- the models do not sufficiently consider key features of information literacy in the workplace which are the social, collaborative and shared nature of the information and its processing;
- the experience and practices related to tasks regarding the use of information can be experienced in a different way in the workplace than in the educational context.

Regarding the second question, the report underlines that most studies highlight the importance and the added value of information literacy related to different work activities, but there are few studies that have tried to evaluate its impact. One study showed the importance of using information in the decision-making processes for employees in five different business sectors (banking, pharmaceutical, public, insurance and medical), but without any quantitative assessment. Only one study calculated the economic impact of the wasted time of employees in

the ineffective search for information in British small and medium-sized enterprises (see Grevies in the first case, DeSaulle (2007) in the second).

Another interesting work of analysis is the review carried out by Weiner (2011) on information literacy in the workplace, which clusters existing research in this field into three broad areas of analysis: the importance of information literacy for the workforce; what differences emerge in informational literacy for work compared to the academic context; and the barriers to informative literacy in the working environment.

Regarding the first point, the skills related to information literacy – described as the ability to locate, understand and use information, to solve problems, to monitor trends and adapt to them, to readjust, recreate and re-contextualise the contents, to self-determine and self-training – are considered necessary for most jobs. For employers, they are connected to the need to update and acquire new skills and are considered strategic in terms of competitive and economic advantage (Cheuck, 2008; Goad, 2002; Klusek & Bornstein, 2006; Gardner, 2000; Lloyd, 2003; Perrault, 2007). It should be emphasised how the skills that are related to the concept of information literacy are varied and different and not always assigned to a homogeneous concept; this confirms the confusion that the concept generates and the need to clarify its meaning.

Regarding the second point, there are studies that have shown how the information needs of workers are different from those of students. Significant differences emerge in the type of activities that workers have to face: the tasks and problems are contextual and not generic, they can be difficult to analyse and in general, they tend to be complex, messy and open, unlike the tasks assigned for study in the university context (Lloyd, 2010; O’Farrill, 2010; Lloyd, 2008; Kirton & Barham, 2005). For this reason, in the workplace, information literacy focuses less on identifying information needs because problems are often very specific and assigned to an employee to solve them (Hepworth & Smith, 2008).

Furthermore, in this context, information literacy is a social and cultural competence. Its acquisition and development are equally strongly influenced by human relationships and collaborative practices (Lloyd, 2010; O’Farrill, 2010; Lloyd, 2008; Kirton & Barham, 2005).

With reference to the last aspect, the responsibility for training in information literacy in the workplace remains a key unresolved issue. Moreover, data or incentives that can push institutions to change are missing. Some research points out that employers see research skills’ training as necessary and easier to carry out in a university setting than a workplace, or to be carried out in the workplace according to a one-to-one mentoring or coaching approach.

1.3 Information literacy for researchers

The term *researchers* refers to ‘professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and in the management of the projects

concerned, as meant in Europe by the European Charter for Researchers and the Code of Conduct for the recruitment of researchers.

The transition from a university student to a scientific researcher poses several challenges, one of which is represented by the information skills necessary to specifically support research activities and the variety of tasks that the researcher has to face once his or her training path is finished. Several studies highlight the difficulties in transferring information skills acquired during university studies to the workplace (Eyre, 2012; Sokoloff, 2012; Crawford & Irving, 2009).

However, there are very few reflections in the literature that focus the attention and the analysis of information literacy covering the target of researchers as workers and not as students in various fields of activity, whether they are public bodies (universities and centres of research) or private individuals (companies and private research centres).

Most studies in this area are focused on the analysis of either research behaviours and access to information or on specific experiences of education in information literacy. Several studies analysed the research behaviours and practices of researchers or their ways of using information in different work contexts, by adopting an institutional perspective (Vezzosi, 2009), a geographical point of view (Vilar, Juznic & Bartol, 2015; Naveed & Rafique, 2018), by subject area (Brown, 1999; Brydges, 2016; Fjällbrant, 2000) or by level of training. Among the latter, there is literature concerning the experiences aimed at this target but often there are no in-depth reviews that evaluate their effectiveness.

1.4 Conclusions

Studies show substantial differences in the characteristics of information literacy in the workplace compared to the educational sphere. They are mainly linked to the social, collaborative and shared nature of the relationship with information, in comparison with the individual dimension of the educational context, and with the attention to the stages of organisation, use and communication of information, rather than the search phase. The sources also differ, with a crucial focus on people, as sources of information.

There is no specific definition of information literacy for work, but the use of the expression ‘effective use of information’ is widespread.

Several studies highlight the difficulties in transferring education practices to information literacy from the university to the work context. Both the type of sources, the necessary skills and the types of problems are very different.

In general, the informative competence for the job and for the target both of adults in general and of researchers in particular requires further studies and research to support the knowledge and bring evidence to ground upon activities and practices.

Chapter 2: Experiences of information literacy education for researchers in Europe

2.1 Information literacy education in Europe

Education in information literacy refers here to a set of educational actions aimed at encouraging the acquisition and development of information literacy, designed and implemented by libraries as educational institutions. As also highlighted in the first chapter, education in information literacy recorded a change of approach at the beginning of the twenty-first century that can be summarised, simply, in the transition from an education very focused on the use of the library, and on the users of the library, to an education in the effective use of information, in all its formats, production and dissemination processes and contexts, addressing everyone.

The review conducted by S. Virkus in 2003 on the studies and experiences in Europe in the previous 20 years, highlights the important amount of educational activities for the use of the library carried out by librarians since the 1980s, and underlined how in fact the European action in this area is a recent movement. Its outbreak in terms of studies and experiences is linked to two key elements: the need to respond to the information overload generated by the technological revolution and the need to train individuals capable of learning and updating effectively throughout their life (Virkus, 2003).

From the point of view of the policies implemented at European level, the studies of C. Basili have highlighted a lack of joint actions in this direction (Basili, 2008, 2011). Although more recently several research actions have underlined the importance of promoting information and media education, in practice there remains a significant lack of data. The development of relevant indicators for the improvement of public policies is still at a starting point (Basili, 2008). More generally, it can be said that the political support of information literacy persists at European level, while heterogeneous and fragmented approaches prevail in the European countries. This occurs despite the fact that a certain number of recognised procedures and standards for the assessment and definition of information skills are available, and could facilitate the task of including information skills in European higher education curricula.

Regarding the diffusion of educational practices in this area in Europe, Virkus's study also highlighted how most educational activities aimed at university students were concentrated in some European countries, which are particularly active (including the UK, the Nordic countries and France). Few activities were carried out in the other countries considered here. In many cases, this is also the result of two different gaps: the low predisposition of librarians to publish the results of

their activities; and the tendency, especially in some countries, to publish in national professional journals in the local language and not in English.

This chapter provides a brief analysis of the experiences of education in information literacy conducted in the five countries participating in the project (Belgium, Latvia, Italy, Portugal and Spain), aimed at the target of early career researchers, doctoral and postdoctoral students, in the disciplinary fields of Science, Technology, Engineering and Mathematics (STEM) disciplines.

The analysis was carried out starting from a collaborative bibliographic search conducted on Web of Science, Scopus and Lisa, with keywords related to information literacy education and the target of researchers, with publication dates in the period 2000–2019. The identified articles were selected, starting from title and abstract, on the basis of the following parameters: country of reference of the activity, type of study (scientific articles and reviews referring to experiences and case studies), subject area (STEM disciplines). Overall, 41 studies were identified and are summarised in the following chapters.

In each country, a survey was also carried out on the existence of public or institutional policies that envisage the acquisition and dissemination of information literacy, to which the project activities may refer.

2.2 Information literacy education for researchers in Belgium

2.2.1 Belgian policies and guidelines for information literacy education

Belgium has legislation regarding ‘open access’ but there is not even one mention of ‘information literacy’ or ‘Recherche documentaire’.

Belgium is a federal state and many government competences (teaching, culture...) have been delegated to regional and community governments. Only the public libraries depend on community government authorities. One of the consequences of this is that there is no global and strategic framework in which information literacy could be developed.

In the area of the libraries, there is a national librarians association (ABD). A national conference of the head librarians of the universities was established in the early 1990s but ceased operations ten years ago. For the past year, its members have been meeting again but without an official mandate. However, Information Literacy Education (ILE) is not one of its concerns.

In Flanders, there is a very active association, the VVBAD, financed by the Flemish government, with more than 1200 members. However, it has no Information Literacy (IL) project. On the more official side, the VLIR (Vlaams Universitaire Raad) has several commissions composed of librarians but none of them are interested in ILE.

In the French-speaking community (Brussels and Wallonia), the situation is different. Several organisations coexist in addition to the ABD. There are also two official bodies, the BICfB that mainly manages joint documentary acquisitions and projects related to open access for universities (van Borm & Dujardin, 2001) and a library commission of the Académie de Recherche et

d'Enseignement Supérieur (ARES) which reports directly to the French-speaking Ministry of Higher Education.

The 'User Training Group of ABD' (which became the EduDOC Group in 1998) focused on IL, was created as an initiative of the University of Liège, in the late 1980s (Thirion & Pochet, 2003). It organised several surveys, held symposiums and conferences and published numerous articles. The last activity was the carrying out of a survey of all students entering higher education presented to IFLA in 2007 (Thirion & Pochet, 2009). The group was disbanded in 2010 due to a lack of projects and active volunteers.

In 2015, a colloquium (Pochet et al., 2015) again brought together the same actors and was the starting point for the creation of a new working group (<https://ilib.be>). This working group is integrated into the library commission of ARES. The only object of this working group is ILE. This working group is currently working on the analysis of a survey of the opinions of higher education teachers concerning ILE.

In 2016, the Belgian Minister of Public Health wrote a conceptual note regarding the need to strengthen the evidence-based practice (EBP) policy in Belgium. She commissioned the Federal Centre of Expertise for Health Care to provide a scientific background to allow the installation of an EBP programme and strengthen the efficiency and quality of care (Adriaenssens et al., 2018). As a result of this work, the EBP Network was launched in 2019.

2.2.2 Experiences and empirical studies in Belgium

The literature allowed us to mainly identify experiences at KU Leuven, UGent and ULiège. Training experiences in other institutions, like ULB (Blondeel, 2018), are not specifically oriented towards professionals, researchers and students at the end of the STEM cycle.

At the University of Liège, Durieux et al. (2018) evaluated whether an educational module on EBP for undergraduate Speech and Language Therapy (SLT) students can improve their EBP competencies. Several IL training sessions (in French and/or in English) were organised for PhD students and researchers. This training has recently been supplemented by a Massive Open Online Course (MOOC) called 'Psychologist and speech therapist: EBP at the service of the patient'.

This university also proposes a wide offer of 80 free training sessions, in French and in English mostly taught by ULiège's professionals. It aims to support researchers, from an early stage to supervisors and principal investigators, to develop their skills and boost their scientific careers. The ULiège library participates actively in this training of PhD students and members of the university. It provides courses about sources of scientific information, issues and methodology, advanced scientific information search methods, introduction to bibliometric indicators and use of bibliographic management software, researching evidence in clinical sciences, principles of scholarly communication, principles of open access, copyright and tools to help compose a data management plan. More than 40 sessions were delivered in 2019.

Librarians of the University of Liège are integrated into training programmes. More than 30 courses are scheduled at study programmes for which a librarian is the holder or co-holder and 23 courses require intervention from at least one librarian. The specificity of the training systems set up is that they are more method-oriented than tool-oriented (Pochet et al., 2013). A scientific information literacy framework has been created in order to progressively restructure all courses and training activities (see English translation: https://infolit.be/5PMIS_EN/). It is also sometimes difficult to get all library-trainers to agree on the basic principles of training. The repository is also a tool for gaining commitment. However, librarians are not considered as teachers in their own right, which regularly leads to problems of coherence and recognition.

At Ghent University, De Meulemeester et al. (2013, 2014, 2018a, 2018b, 2018, 2019a, 2019b) developed and validated a scale for the evaluation of medical students' information literacy self-efficacy (ILSE) beliefs and looked for a possible relationship between a progress test in information literacy (PTIL) and ILSE. De Meulemeester et al. also studied, in 2016, health-researchers' current views and needs on information literacy skills concerning research planning, deontology and visibility using a cross-sectional Web-based survey. In addition, De Meulemeester et al. (2018) elucidated the extended, user-tailored approach provided by medical and health sciences libraries in Belgium, motivated by the recent changes in user expectations and behaviour.

At the Catholic University of Leuven, Hannes et al. (2007) explored the barriers to evidence-based nursing among Flemish (Belgian) nurses. Still at the Catholic University of Leuven, Buelens et al. (2007) investigated whether the type of guidelines provided for a group discussion had an effect on either or both the quality of this asynchronous group discussion and the appraisal of participants in the context of a course in medical ethics.

In the same institution, 2BIC's project brings together the libraries for the Science, Engineering and Technology Group and the Biomedical Sciences Group. In this institution, information literacy is part of the curriculum. Additionally, 2BIC's librarians have noticed uncertainty about IL skills among PhD students. In this context, 2BIC surveyed students in order to identify their needs. On the basis of this survey, the library organised pop-up sessions. These sessions are short (40–60 minutes) and flexible when it comes to organisation: various hours, location, language and so on.

The Belgian Centre for Evidence-Based Medicine – Cochrane Belgium also organise several training sessions about EBP (with a focus on how to formulate a question, how to search for information and how to critically appraise papers).

2.3 Information literacy education for researchers in Italy

2.3.1 Italian policies and guidelines for information literacy education

Over the past 15 years, the series of reforms that occurred in Italy profoundly changed the country's education and training system and, from the point of view of this report, opened up

opportunities to insert information literacy education courses into this system more in formal education than in informal and non-formal education.

In the school context, these reforms (including Ministerial Decree 139/2007, Ministerial Decree 254/2012) were inspired by the principles of competence-based teaching and introduced training courses aimed at achieving the key competences for lifelong learning defined by the Recommendation of the European Parliament (2006, update 2018). In parallel, the MIUR (Italian Ministry of Education, University and Research) through the National Digital School Plan (PNSD) funded various actions in support of information literacy education activities and promoted a specific curriculum for digital civic education that also included IL.

Additionally, in the university context, in line with EU policies within the European Area for Higher Education (SEIS), a deep reform of the university system was implemented (among others DM270/2004; DM 16/03/2007, L.30/2010), also inspired by the principles of competence-based learning. The emphasis, in this case, has been placed on the development of links with professionals outside higher education and research, with a view to the professional employability of students, the development of lifelong learning and training in research practice in order to promote quality, innovation and internationalisation of research results.

Regarding for the implementation of IL education paths, particularly interesting is the adoption of the Dublin descriptors provided by the Framework for the Qualifications of the European Higher Education Area (EHEA), which define the five types of learning that students must have acquired at the end of the planned study programme: knowledge and understanding, applying knowledge and understanding, making judgements, communication skills, learning skills.

In 2019, the Libraries and Teaching Work Commission of the Conference of Italian University Rectors (CRUI) defined guidelines for achieving information skills in Italian universities.

In the research sector, the recent National Research Programme 2015–2020 emphasises the importance of developing training for PhD students in terms of innovation, internationalisation and interdisciplinarity, financing actions that can enhance the acquisition of transversal skills, useful both to research activity and a better inclusion in the world of work.

Regarding professional updating, Italy has implemented the European recommendations regarding professional qualifications, certification of competences and recognition of informal and non-formal learning through various laws. All professional associations (in STEM fields, for example, engineers, chemists, physicians) must organise for their associates' professional training which provide for recognition of professional credits (DPR 7 August 2012, n. 137). In 2013 with Law 4/2013 this obligation was also extended to non-regulated professions.

The reference policies related to information literacy actions are those of the ministries involved in lifelong learning issues: the Ministry of Education, University and Research and the Ministry of Labour and Social Policies.

Additionally, the Agenzia per l'Italia Digitale (AGID i.e. Agency for Digital Italy), a technical agency of the Presidency of the Council of Ministers, plays a key role because of its mission of

ensuring the realisation of the Italian Digital Agenda objectives. The AGID sustains digital innovation and promotes the spread of digital competencies.

In Italy, librarians play the main role in the implementation of information literacy training activities. The Ente nazionale italiano di unificazione (UNI) reference standard for the profession (UNI 11535: 2004) recognises, among the fundamental tasks, that of ‘implementing programmes of lifelong learning, information literacy and cultural promotion’.

The Italian Library Association is the national association that established a reference register for the profession and a national Study Group on Information Literacy (GLIT), active since 2011. In 2016, the association published the Manifesto for Information Literacy.

In the environmental field, the SI-Documenta Network of the National System for Environmental Protection promotes, among the 2018–2020 programming objectives, the creation of courses on the use of available resources and the best research strategies.

In the medical field, a key role is played by consortia of biomedical libraries, in particular by the Biblosan consortium, promoted by the Ministry of Health, by the GIDIF-RBD Association which provides refresher training for biomedical information professionals and by GIMBE – a non-profit foundation – which aims to promote Continuing Medical Education and Evidence-Based Medicine for professionals.

There are several other professionals – represented by their own order or by specific associations on the national and regional territory – active in Italy on topics near to or overlapping with information literacy, including journalists (who carry out training on fake news and correct journalistic information), historians and archivists (who carry out activities related to sources and information retrieval), teachers and educators active in the field of communication and media, the community of volunteers supporting Wikimedia projects, active in training in the use of resources and knowledge synthesis.

There are three Italian documents to which reference can be made on IL education activities:

- a. The Manifesto for Information Literacy produced by GLIT; a non-prescriptive document that underlines the importance of adopting an educational approach centred on the contemporary citizen intended as an active producer of information and not just a passive user. For this reason it is necessary to develop projects and educational activities that allow mastery of the different dimensions – economic, technological, cultural and social – of information in order to be able to actively participate in the knowledge society. The document suggests some possible learning scenarios.

- b. The CRUI guidelines for the achievement of information skills of Italian universities’ graduates. The document aims to solve the problem of students’ poor ability to use information sources for studying. The guidelines adopt the Association of College & Research Libraries (ACRL) definition of IL and identify six areas of knowledge to be developed. The document insists, on one hand, on the teachers’ responsibility to foresee, within their teaching activities, disciplinarily relevant tasks that require students to be made

aware of the use of information sources, in order to stimulate the development of skills and abilities, and on the other hand, on the responsibility for librarians of academic and research libraries to offer information skills' training and to activate extensive and systematic forms of collaboration with teaching staff.

c. The AGID digital skills guidelines refer to the DIgCOMP 2.1 European framework, where data and information literacy are considered one of the areas of digital competence that every citizen and professional should acquire and develop throughout life.

2.3.2 Experiences and empirical studies in Italy

The literature allowed us to mainly identify experiences at the University of Parma. Training experiences in other institutions are not specifically oriented towards professionals, researchers and students at the end of the STEM cycle.

The only Italian experience reported in the scientific literature which can be considered as partially adherent to our target, is that carried out at the University of Parma. Since 2001, in fact, the University of Parma piloted an information literacy training called 'Dalla biblioteca alla rete' (from the library to the Web) addressed to university students from various faculties including STEM disciplines. Initially, the training, conceived by a group of librarians as part of their own professional training, was piloted with 45 students, with the aim of including libraries within the institutional teaching activity as foreseen by the newly adopted reform of the educational system [D.M.509/99].

The librarians who participated in this experience focused their objective on creating a training activity that could be institutionalised and integrated with university courses. The project consisted of organising a seminar for university students aimed at developing the information skills necessary to use information resources in a conscious, competent and critical way (Mamoli, 2005).

In less than one year, the training obtained the recognition of the Governing Council and was formally included in the university training offer, making possible the attribution of educational credits (CFU). In the second half of 2002, four seminars were held, with the participation of 130 students from almost all faculties of the university.

After some years, this experience constituted the starting point for further developments: the University of Parma experimented with a new approach to enquiry and practice in the field of information literacy through the adoption of action research methodology for investigating the impact of an IL programme on a homogeneous group of students. The project consisted of a cycle of four stages: observing, planning, acting, evaluating. Peer observation was adopted both as a validation method and as a support for reflection on the research process.

The learning activity consisted of a programme comprising 20 hours of class activity and 15 hours of individual and group activity, organised in cooperation with the ecology teacher, as an introductory part of the ecology course. The cooperation between the subject teacher and the

teaching librarian was useful in connecting the contents of the IL activity with some topics perceived by the students as important and meaningful (Vezzosi, 2006).

For the purposes of this report, the elements which are particularly interesting in the Parma experience are mainly related to the use of action research methodology itself, as a way to know better the students' needs and, at the same time, to improve the librarians' competence in teaching.

The action research methodology was chosen because of its characteristic of bringing together enquiry, practice and reflection and this experience was considered a pilot study for a new approach to IL at the University of Parma, an approach in which research into students' learning and self-evaluation could empower librarians' teaching practice (ibidem).

Regarding evaluation of the learning outcomes, being a research project, the experience included the introduction of a number of different assessment methods in order to analyse students' learning from a variety of points of view.

In this regard, it is interesting to mention the experience of the library of Libera Università of Bolzano, which is a teaching information centre for the university, but also for other organisations and external users.

The IL assumption supported by the library is that the actual transmission of information skills depends on the link between the educational initiative and the specific disciplinary context of the student. This connection has allowed the integration of compulsory information literacy courses and the official courses of the university (Buoso, 2008).

The method adopted involves the analysis of a case study, presentations by librarians about particular themes or resources, the discussion of the results and the strategies selected in individual or group research of participants. The argument is chosen according to the disciplinary field of the students to whom the course is aimed.

In addition to courses for undergraduates, a specific course is addressed to doctoral students, including students in science and technology. The course introduces the topics of scientific information, scientific publication, bibliographic research and plagiarism. These courses are usually provided in English, integrated into the course of study, and can last from 10 to 20 hours. They are face to face courses with practical exercises. In some cases, attendance is mandatory. The university employs subject librarians, in charge of the reference and training service.

Italian experiences are not frequently reported in peer-reviewed literature. Notwithstanding this, some universities are active in the field of the information literacy education for a long time, and have developed a structured programme of courses, for example the University of Bologna, LIUC University and Libera Università of Bolzano (Lucchini, 2007).

In particular, specifically addressed to postgraduate students or researchers in STEM disciplines are the following experiences:

The library system of the University of Urbino organises a single course for all doctoral students – transversal to all humanities and scientific disciplines – introductory to the issues of scientific publication (bibliographic research, open access, copyright, bibliometric indicators). The

course consists of three meetings (9 hours in total), including one practical session and it is compulsory but does not involve credit recognition.

The La Sapienza University of Rome also organises courses for doctoral students. In the STEM disciplinary field, the Library of the Department of Structural and Geotechnical Engineering organises a 10-hour course called ‘Information literacy skills and research strategies’ to introduce postgraduate students to the principles and practice of information literacy as applied to PhD research. The five-week programme consists of five 2-hour ‘hands on’ workshops, which enable students to build their research skills, research methods, academic writing and communication. The course is embedded in the course of study and recognised with the release of 2 European Credit Transfer System (ECTS).

2.4 Information literacy education for researchers in Latvia

2.4.1 Latvian policies and guidelines for information literacy education

In regulatory documents from Latvia, information literacy is seen as a component of media literacy. Media literacy is a set of knowledge and skills necessary for working with information sources – finding and analysing information, understanding the functions of information providers, critical evaluation of information content, distinguishing objective information from biased, comparing information available in different sources to form a reasonable opinion. Media literacy also includes the ability to use media in practice.

This area is currently governed by two main laws:

1. On the Press and Other Mass Media (Legal acts of the republic of Latvia, 1990).
2. Electronic Mass Media Law (Legal acts of the republic of Latvia, 2010).

The main governing/regulatory documents are:

- 1) Cabinet Order No. 667 ‘Mass Media Policy Guidelines of Latvia 2016–2020’ (Legal Acts of the Republic of Latvia, 2016).
- 2) Cabinet Order No. 666 ‘Plan for Implementation of the Mass Media Policy Guidelines of Latvia 2016–2020’ (Legal Acts of the Republic of Latvia, 2016).

The guidelines and their implementation plan are applicable to the territory of the Republic of Latvia and extraterritorially – to the diaspora of Latvia (in two aspects: providing for the provision of support for the creation of quality content of public significance in diaspora mass media and to the representation of diaspora topics in mass media content in Latvia).

Another document is the cultural policy guidelines 2014–2020 "Creative Latvia" (Ministry of Culture, 2017). The related goals are to develop and implement information and media literacy

programmes for librarians and library users, and organisation of information literacy training for specialists in economic sectors.

Responsible institution: Ministry of Culture (MoC).

Co-responsible institutions:

- Public administration: Ministry of the Interior (MoI), Ministry of Foreign Affairs (MoFA), Ministry of Education and Science (MoES), Ministry of Welfare (MoW), Ministry of Transport (MoT), Ministry of Justice (MoJ), Ministry of Environmental Protection and Regional Development (MoEPRD).
- Educational institutions: University of Latvia (UoL), Riga Stradiņš University (RSU) and Vidzeme University of Applied Sciences (ViA).
- Professional organisations: Latvian Association of Broadcasting Organisations (LABO), Latvian Press Publishers Association (LPPA), Information and Communications Technology Association of Latvia, Latvian Advertising Association (LAA), Latvian Association of Journalists (LAJ), Latvian Union of Journalists (LUJ).
- Other: National Electronic Mass Media Council (NEMMC), State Chancellery, National Library of Latvia (NLL), representatives of the mass media environment of Latvia from both public service media and private mass media.

Plan for implementation of the Mass Media Policy Guidelines of Latvia 2016–2020

The plan for implementation of the Mass Media Policy Guidelines of Latvia 2016–2020 (hereinafter – the Plan) is a medium-term policy planning document which has been developed by the MoC.

The objective of the Plan is to offer specific action directions and measures for achieving the objectives defined in the guidelines, to determine the responsible authorities and time limit for implementation of measures, and also to provide an indicative indication of the necessary funding for implementation of the measures or activities provided for in the Plan.

In total, the Plan has five lines of action. Two of them (3rd and 4th) concern media literacy, which also includes information literacy.

Tab. 2 Plan for implementation of the Mass Media Policy Guidelines of Latvia 2016–2020, Action 3

3. Action Direction – Education of professionals of the mass media sector

3.1. To improve the quality of mass media and journalism studies

Measures:

- To assess the possibility for the state institutions of higher education to implement a cooperation model which would allow:

- 1) Offering the same study courses for students of different institutions of higher education by the heads of mass media and journalism study programmes and/or
- 2) Creation of joint groups of students of journalism study programmes of different institutions of higher education for acquiring specific study courses;
- 3) Promotion of cooperation projects of institutions of higher education in the mass media sector and international cooperation programmes in the fields of mass media and journalism.

(Responsible institution: MoES; Co-responsible institution: MoC)

- To promote communication of professional organisations of mass media with makers of higher education study programmes in mass media studies and journalism *(Responsible institution: MoC; Co-responsible institution: MoES)*.

- To support innovative projects promoting interaction of education and professional mass media environment. For example, a discussion regarding the possibilities and quality of mass media and apprenticeship of journalism students *(Responsible institution: MoC; Co-responsible institution: MoES)*.

3.2. To support lifelong learning of mass media professionals

- To educate journalists in further education activities organised by the Baltic Centre for Media Excellence *(Responsible institution: MoFA; Co-responsible institution: MoC)*.

- To implement international cooperation programmes for further education and raising of qualification of journalists in cooperation with NGOs and mass media organisations (More detailed development of the project is being created in a separate policy planning document) *(Responsible institution: MoC; Co-responsible institutions: MoFA, professional NGOs, mass media and academic organisations)*.

Tab. 2 - Plan for implementation of the Mass Media Policy Guidelines of Latvia 2016–2020, Action 4

4. Action Direction – Media literacy

4.1. To survey the level of media literacy in society

- To conduct studies regarding media literacy in society *(Responsible institution: MoC)*.
- To establish the UNESCO Chair on Media and Information Literacy *(Responsible institution: MoES (UoL SSF – the project implementer); Co-responsible institution: UNESCO LNC)*.

4.2. To improve the knowledge of society on media literacy

- To educate users from different groups of society in media literacy *(Responsible institution: MoC; Co-responsible institutions: NLL, LAJ)*.
- To educate mentors in media literacy for the acquisition of media literacy outside schools *(Responsible institution: MoC; Co-responsible institutions: NLL, UoL SSF)*.
- To organise training for specialists in youth affairs of local governments *(Responsible institution: MoC; Co-responsible institutions: MoES, UoL SSF)*.

- To inform persons working in the field of youth regarding media literacy (*Responsible institution: MoES; Co-responsible institution: MoC*).

4.3. To include in mass media such content which develops media literacy

- To support the development of the mass media criticism genre in mass media (within the framework of mass media support programmes) (*Responsible institution: MoC*).
 - To promote critical thinking of society in respect of perception of mass media content and assessment thereof (critical discussion). (Detailed layout – in a separate policy planning document) (*Responsible institution: MoC*).

4.4. To include media literacy in the content of education

- To develop media literacy for children of pre-school age and pupils of elementary school (*Responsible institution: MoC; Co-responsible institutions: MoES, NCE*).
 - To organise events promoting media literacy and education in media literacy for pupils and youth, using a debate method (*Responsible institution: MoC; Co-responsible institutions: NGO, service*).
 - To ensure information for a youth audience regarding the possibilities provided by the programme 'Erasmus+: Youth in Action' in respect of the creation of international informal education projects which focus on media literacy (*Responsible institutions: MoES Agency of International Programmes for Youth; Co-responsible institution: MoC*).

4.5. To educate teachers for teaching media literacy in educational institutions

- To organise seminars for teachers regarding media literacy (*Responsible institution: MoC; Co-responsible institutions: NLL, UoL SSF*).
 - To ensure cross-disciplinary (communication science and pedagogy) exchange and transfer of experience within the framework of the Media Literacy Programme of the Mass Media Support Fund (*Responsible institution: MoC; Co-responsible institutions: MoES, LAJ*).

4.6. To prepare would-be teachers for teaching media literacy in educational institutions

- To inform regarding the possibility of obtaining pedagogical education and experience for teaching media literacy within the framework of study mobility of the EU Erasmus+ programme (*Responsible institutions: Institutions of higher education which offer study programmes for teachers; Co-responsible institution: State Education Development Agency of the MoES*).

4.7. To create materials for teachers regarding media literacy issues

- To translate examples of international practice regarding media literacy issues (*Responsible institution: MoC; Co-responsible institutions: MoES, NCE, service*).

2.4.2 Experiences and empirical studies in Latvia

In order to start IL training, the existing level of knowledge of students should be considered. When surveying the Riga Technical University (RTU), UoL and Riga Stradiņš University (RSU)

libraries, regarding whether the assessment of students' previous knowledge of IL was carried out at the beginning of doctoral studies, it was concluded that such assessment was not practiced.

If the doctoral students had library classes in IL, then it was assumed that they had a basic knowledge, but it was not tested. Usually, at the first meeting, skills and knowledge are tested in the form of interviews with specific questions. Students' skills and knowledge are very different. There are doctoral students who are able to find, understand and analyse information because they are actively engaged in research, therefore, they are familiar with scientific information searching resources in their field. However, there are also students in the same class who have not actively used the resources offered by the university during previous study levels, thus, they do not have sufficient skills in information gathering and selection. Occasionally, bachelor or master studies of doctoral students have been completed at one university, but doctoral studies take place at another university. For example, often doctoral students have previously studied at the Faculty of Medicine of the UoL, but continue to study at RSU. The level of knowledge and skills varies because IL training differs at both universities.

In addition to traditional lectures, practical classes for IL learning are also used, and one-to-one consultations offered. The most successful way to implement IL training is by linking these classes with the learner's field of study and research topics. In the RTU, the UoL and the RSU, librarians who support the development of competencies of IL skills for doctoral students coordinate the content of classes with those who are responsible for the programme, e.g. programme directors or professors.

In Latvia, all higher education institutions have an introductory lesson at the library during the very early stages of studies. In those IL classes, students are introduced to the terms of use of library resources, available e-resources, the possibility of using these resources remotely and other library services.

For example, at the UoL, IL is integrated into the course of regular curricula such as 'Introduction to studies and research methodology' at the faculty of Economics and Management (Krumina & Parsova, 2010).

Classes for bachelor's and master's students at the UoL and RTU are organised according to the request of the departments. In recent years, doctoral students have been offered certain topics that are integrated into various courses at the request of the departments. This is more often done in courses related to writing a dissertation. Both, the UoL and RTU do not have much response from faculties. Libraries have developed course topics, but demand is very low.

Riga Stradiņš University has a different experience. RSU has been developing an IL course for ten years. The library currently offers a course for doctoral students (medicine, pharmacology, dentistry), 'Information Technologies and Informational Literacy'. The aim of the programme is to improve the quality of the study process in the field of information searching, retrieval and processing. The length of the course is 16 academic hours. At the beginning of the course, there is a theoretical lecture, but after that there are several practical classes, in which students perform various tasks related to a research project. At the end of the course a test is provided.

None of the above-mentioned universities conduct research on how the teaching of IL affects the academic achievements of doctoral students.

As there is no unified policy and guidelines in Latvia for teaching IL, each university library develops its own programme. There is a professional organisation in Latvia – the Association of Latvian Academic Libraries. From time to time, the question of common guidelines for teaching IL comes to the forefront of this organisation, but as there are international guidelines, the association recommends that university libraries follow these.

2.5 Information literacy education for researchers in Portugal

2.5.1 Portuguese policies and guidelines for information literacy education

In Portugal, the main actors in the process of education of information competencies are public administration, educational institutions and professional organisations.

The resolution 48-D/2017 of the Council of Ministers (Conselho de Ministros, 2017) approved the guidelines for the National Reading Plan 2027, assigning local authorities, sectors of culture, science, technology, higher education and education, the development of an integrated policy to promote reading/writing and multiple literacies, namely, scientific and digital. The resolution 26/2018 of the Council of Ministers (Conselho de Ministros, 2018) presents the 2018–2030 strategy for digital development, concretised by the National Initiative for Digital Competences (INCoDe.2030, 2017), with ‘information literacy’ as a key area (Conselho de Ministros, 2019). The INCoDe.2030 relevant axes for this project are education, specialisation and investigation. For education, the initiative addresses the revision of higher education curricula and the use of new pedagogical approaches (thus aligned with the ‘Bologna Process’). The specialisation axis, proposes the creation of a national network of training programmes for recent graduates and professionals. The investigation axis emphasises the need to qualify new researchers in digital skills for collaborative scientific work. The coordination of this axis is assured by the Foundation for Science and Technology, under the responsibility of the Ministry for Science, Technology and Higher Education.

The Portuguese Association of Librarians, Archivists and Documentalists (BAD), includes a Working Group for Higher Education Libraries (GT-BES). In 2016, GT-BES systematised a list of ten recommendations for higher education libraries in Portugal, highlighting the relevance of IL skills, the development of skills of library professionals to support education activities, the role of the library in supporting research and promoting access to information.

2.5.2 Experiences and empirical studies in Portugal

In Portugal there is little published information regarding the development of IL competences in future researchers through formal courses. One of the few examples is a course on IL in a doctoral programme at the Universidade Nova de Lisboa (Andrade et al., 2015). This 28-hour

course (1 ECTS) is available to all PhD students and all postdoc researchers and lecturers in that university (UNL, 2020). The important IL components of the course are: ‘Use of resources and development of research strategies’; ‘Evaluation of information sources’; ‘Plagiarism, citations and bibliographic references’; and ‘Bibliometric and scientific publication’. It ends with a seminar and a final reflection on the IL concept and the importance of critical thinking in the management of available information resources. This course emphasises the importance of student-centred work, the articulation between academics and librarians and the integration of the programme in the academic curriculum. The assessment is based on a multiple-choice test, individual participation in the classroom and practical exercises carried out in small groups, later presented orally by one of the members and then discussed by all students and trainers. Some difficulties were highlighted (Andrade & Prates, 2010), including: lack of dedicated administrative coordination; lack of library staff; difficulties in coordinating collaboration on the project; insufficient dissemination and marketing; need for general analysis and evaluation of results.

Another example of a published study comes from the Instituto Superior de Psicologia Aplicada (Lopes, 2015) regarding a curricular unit called ‘Communication and Bibliographic Resources’, aimed at students from the Master’s in Community Psychology. This ECTS curricular unit syllabus follows the Dublin descriptors and the ACRL standards, related to general and specialised resources in the field of psychology.

In Portuguese universities, the adoption of curricular units dedicated to research methodologies in their masters and doctoral programmes is more or less widespread. In those curricular units, the development of IL aspects are included in many different forms. Examples of aspects of IL included in the curricular units’ syllabi are:

- ‘Critically reviewing the literature; referral systems and use of electronic research media’, ‘Negotiating access and research ethics’ – topics listed in the ‘Research methods’ curricular unit of the Master’s degree in Industrial Engineering at the University of Minho (University of Minho, 2020).
- ‘Perform literature searches in online databases’, ‘Analyse critically the published literature by using evaluation guidelines’, ‘Formulate the question/research problem’, ‘Identify and plan a study design and methodology for collecting data’ – topics in Research Methodologies and Data Analysis (University of Aveiro, 2019).
- ‘Acquire comprehensive and up-to-date knowledge of the literature related to his research area’ – Research Methodologies course – Doctoral Programme in Sustainable Energy Systems (University of Porto, 2019).

A limited number of Portuguese experiences are reported in the scientific literature, while in Portuguese universities the adoption of curricular units dedicated to research methodologies in their masters and doctoral programmes is more or less widespread in STEM fields as well as in other fields of knowledge. Libraries are often invited to teach specific topics related to IL.

2.6 Information literacy education for researchers in Spain

2.6.1 Spanish policies and guidelines for information literacy education

The key actor in the process of education regarding information competencies or skills in Spain is the Ministry of Education (public administration).

In the document ‘Integration of information literacy competencies in the educational system: references, context and proposals’, written 2016, there are, as a conclusion, 10 urgent measures for literacy both in information and media:

1. Transversal education programme: To build a creative dialogue between experiences and initiatives from many different fields of formal, non-formal and informal education.
2. An annual budget for school libraries.
3. Content factory: To promote co-creation processes of open content, with the involvement of agents, groups, mixed work teams from diverse environments and settings.
4. A specialist in information and knowledge management in each school centre.
5. An experimental network of flexible educational centres. An experimental network of flexible educational centres that have the conditions to explore and evaluate the impact of forms of teaching and school organisation articulated around interdisciplinary learning projects.
6. A training itinerary for direction, consultancies and educational inspection.
7. Budget for each school library that meets the International Federation of Library Associations (IFLA) 2015 requirements.
8. Best practices award.
9. Interdisciplinary research line.
10. Year literacy in information and media 2017: 2017 was declared as literacy in information and media year, planned as 12 months of mobilisation around the different lines of work (institutional support, financial endowment, regulatory framework, training, content, good practices, innovation and research). It opened with a large-scale Open Space organised around ten critical areas.

2.6.2 Experiences and empirical studies in Spain

The design of new curricula, as a result of the EHEA, and new teaching methodology has meant an opportunity to overcome traditional training provided by Spanish university libraries. The aim of González (2013) is to report the state of affairs of training in information management competency over the past three years in Spanish university libraries and to present the role of the Spanish University Library Network. On the other hand, Uribe-Tirado’s (2017) study involved the research of 131 universities, 58 IL experiences selected, 44% of universities with IL experience, 135 analysed documents, 35 interviews and 29 surveys, providing a 75 lesson framework that deals

with the specific social and organisational context, on teaching and research processes, on learning processes, and on quality assessment and continuous improvement processes.

On the other hand, Uribe's (2012) work reviews the information presented by the websites of the libraries of the Spanish higher education institutions on this training activity and generates a description and classification of the levels of incorporation of the informational competencies that they present. This study evidences with concern, that in the case of the Spanish university libraries there is a considerable number/percentage of institutions (43–57%) in which all premises or one of them is not being fulfilled, to which these institutions should direct their attention, considering the effects on the quality of education that IL has. However, when focusing on the universities that do present information on some level of training, it is noteworthy that 29 institutions (39%) are already in levels 1 or 2 of IL according to the categories that are considered in this investigation.

Another relevant work is Sicilia (2018), who notes that the interest in digital skills' training has resulted in frameworks and offerings at different educational levels. There, the results of a trans-national study on the perceptions of different stakeholder groups (namely students, employers, instructors and civic institutions) about the relative importance of digital competencies, the effectiveness of current offerings and the best approaches for their acquisition are reported. The results show some differences in perception across groups and a clear focus on information searching and communication abilities as priorities, but also to a perceived gap between the needs and actual abilities of students. The results also point to situated and problem-based learning approaches as adequate instructional methods.

Regarding Valle Santos (2018), they claim IL may be broken down into various dimensions – access, evaluation and use – and these skills are not independent. Their research shows how persons skilled at applying information will lose their advantage if they are not skilled at interpreting or prior selection. Second, their study also shows how IL skills have differing effects on the different components of academic performance.

Furthermore, Pinto (2012) notes self-assessments of high levels of information competence among those surveyed. Although there were differences concerning the degree of perception among the different items, it can be seen that, with respect to almost all topics, the majority of respondents perceived their levels of competence to be high and there were very few information competencies in which those surveyed recognised a low level of competence.

2.7 Conclusions

The review carried out on existing policies and guidelines in the target countries shows that, in most cases, there is no specific policy on IL education. As this is a transversal competence, it also has an impact on very different fields, including for example the medical one, the communication one or university studies. The policies do not seem to result in structured action plans in any of the

analysed countries: the action is left to the individual institutions where it reaches the level of institutional programming.

From the point of view of the analysis of experiences, the presence of a limited series of studies for the target of adults and researchers and for the disciplinary field of the STEM disciplines is confirmed – even if in Belgium and partly in Spain there is a rich offering of training activities from universities and other institutions. Studies often do not report some essential information, such as the idea of the underpinning informational literacy, the teaching methodology adopted or the type of evaluation.

Chapter 3: Perception and experiences in the use the technical-scientific information in research work

3.1 Participants' profile

With the aim of deepening the relationship between researchers scientific and technical information (STI), five focus groups and some in-depth interviews were organised in the countries participating in the project. The aim of the focus groups was to explore how researchers perceive and experience the use of STI at work.

Each BRAIN@WORK partner organisation hosted and managed a focus group, each group was led by a moderator through an open discussion structured around predetermined questions on the following three topics: the perception of STI; difficulties and criticalities experienced in the use of STI; and their relationship with the learning of IL.

Overall, 38 people were involved, including 19 men and 19 women, with the following geographical distribution: 13 Italians, eight Belgians, eight Portuguese, six Spanish, five Latvians. Most of the participants (27 people) were researchers, nine were university professors and two held both roles. The researchers were mainly PhD students or early career researchers (13 R1–R2 according to the European Union), eight were R3 established researchers, while five did not indicate their career level.

The participants came from different disciplinary fields distributed in the following four macro-disciplinary areas: 15 people from the engineering area, 10 from the chemical area, five from the physical area and four from the medical area.

Tab. 3 The four career stages outlined and defined in the European Commission's communication 'Towards a European Framework for Research Careers'.

Source: https://cdn5.euraxess.org/sites/default/files/policy_library/towards_a_european_framework_for_research_careers_final.pdf

R1	First Stage Researcher (up to the point of PhD)
R2	Recognised Researcher (PhD holders or equivalent who are not yet fully independent)

R3	Established Researcher (researchers who have developed a level of independence)
R4	Leading Researcher (researchers leading their research area or field)

3.2 Perception of scientific and technical information

Participants were asked questions about their perception of STI. When asked about work tasks in their job where STI is needed or contributes to the solution, participants mentioned many different tasks.

The main tasks mentioned were:

- for writing scientific articles/publications (mentioned 12 times);
- for new research projects – to gather information and what has been done before etc. (9 times);
- for teaching, for example, when preparing lectures and lessons or materials for students (8 times);
- to develop methodology (6 times);
- to prepare project proposals (6 times);
- to stay updated periodically on the state of the art in one's field (5 times);
- use of literature as inspiration to set up new experiments/for the design of experiments (5 times);
- for new protocols (4 times);
- to summarise data and information (4 times);
- to discover and analyse networks and ongoing collaborations between other research groups/to identify researchers with whom to collaborate (3 times);
- for pure knowledge (2 times);
- to understand/to compare with other results, for example, laboratory results (2 times);
- to revise/review an article (2 times).

When asked about cases where information has been found effectively, the answers differed. Although not everyone could give positive examples, the following are some of the **positive cases when information was found and used effectively**:

- some participants mentioned different databases or scientific documentation sites as the most convenient (and efficient) way to find information. Databases and tools that were

mentioned included: *Primo (Primo Discovery)*, *PUBMED*, *EBSCO*, *Web of Science*, *Sci-hub* and other access sites;

- by looking at STI, they found an easier and simpler way to design the experiment;
- for one participant, it is effective every time when he carries out his work tasks;
- for different tasks like preparation of articles, thesis plans and meetings;
- in the planning and design of research work;
- using free time to read and update on scientific literature – that way information can be used more effectively when needed;
- also, when it is known what actions need to be taken to find the needed information.

Some participants indicated **problems with using information effectively**:

- four participants directly contacted other researchers (or author of the found article) to find out needed information (in one case it was local information, in another case – with just using scientific information – they could not achieve their goal);
- one participant has not been able to find the necessary information on his own yet;
- it was noted that sometimes it is difficult to formulate the search phrase;
- others say that one of the main problems is that there is too much STI, also that there is no organisation of scientific literature.

Participants' **perception of STI is that it is useful for day-to-day work** at university and for everyone who deals with it. As a scientist, you cannot exist without information because it can be used in many ways – it helps to enrich knowledge about specific topics, it helps to understand what has already been done in the field. Finally, STI is useful in all areas of life.

To summarise, participants cannot work or undertake research without using STI – it is used on a daily basis. Databases and other documentation sites are great tools to effectively find information, although sometimes they are not enough, or it is hard to find the specific element because of information overload.

3.3 Critical experiences in the use of scientific and technical information

Participants were asked questions about their experience of issues in using information, about difficulties encountered at work in finding, evaluating, managing and applying information – also about the strategy applied to obtain the necessary information. Although problems and strategies – depending on the STEM discipline – differ, the **main problems, that participants indicated, were**:

- time needed to sort out the information/databases/journals (lack of time; mentioned 10 times);
- too much STI, not all of it is good quality; need for validation (9 times);

- problems with sharing and organisation of documents/bibliography – end up downloading the same document several times (6 times);
- sometimes difficult to access needed information because some materials/articles are not free (4 times);
- information overload (3 times);
- ‘publish or perish’ – the pressure to publish academic work (3 times);
- requires a skill (or knowledge) to know how to find information needed (3 times);
- too many options – which is the best? (3 times);
- difficulty with keywords (incorrect keyword choice; 2 times);
- lack of communication between researchers and between the results and the state of research between the various working groups (1 time);
- evaluation of the importance of literature based on the proprietary algorithm of relevant bibliographic databases (‘most viewed articles’, ‘most read articles’ functions; 1 time).

One of the strategies, if it is difficult to find the needed information, **is to ask for help from others** – for example, ask for help from a library employee (mentioned 3 times), consult electronically or ask colleagues who are better at navigating search tools (4 times). Additionally, a solution can be to find specialists. **Another strategy** is to organise scientific papers by a specific theme.

If the article found is not free, participants either contact other researchers or authors who might have access or refer to articles that are available for free (that, on the other hand, diminishes the scientific value of the research work).

Some have adopted an online file sharing environment that reduces time used for finding STI (mentioned 3 times). Others use platforms like *ResearchGate*, which offers a question/answer service where researchers can ask other researchers questions and that way solve the problem of information overload.

Others have personal keyboards – when there is a new concept, they make a simple table, classify the reference, and make labels or keyboards (mentioned 2 times). Another strategy is using *Mendeley*, which is a reference manager (mentioned 2 times). One participant suggested reading good reviews to evaluate good quality articles.

Overall, participants tend to share and discuss with their teammates/colleagues or have regular meetings (mentioned 12 times).

3.4 Learning information literacy

Participants were asked questions about learning information competences – why these competences are important to achieve their work objectives, how participants could describe their

approach to learning to use information and their preferences to update and learn these competences.

Information competences are important to achieve work objectives because: researchers' work and publications depend on them, nothing is going on without information, it is important to achieve work objectives. They help in identifying, gathering, selecting and processing information from a variety of sources.

When describing approaches for learning to use information, many participants noted that:

- their approach is best described as self-learning or self-experience (mentioned 10 times);
- they participate in forums where they attend individual lectures (2 times);
- others search for tutorials to get the most of each tool (1 time).

Training would be helpful/useful for the following competences:

- on how to evaluate articles – good ones from bad ones;
- how to be up to date on articles;
- comparison of new tools vs others, knowing the newest tools;
- how to organise STI;
- data visualisation;
- how to communicate.

Online courses, webinars, workshops, written tutorials, presentations, as well as **video tutorials, training** and **help from experts** were mentioned when asked about their preferred way to learn these competences. One participant noted that these competences can only be updated and learned with real research projects associated with real society problems.

Additionally, one participant emphasised that younger researchers have more competences because they have a more effective ability to understand new things.

To summarise, when working in the academic field, it is impossible to work without knowing how to use information/how to find it, skills like these are important to achieve both professional and personal goals. Many of the participants have not had dedicated training on information competences but have learned them by self-experience and self-learning. Participants agree that training is needed to improve these competences.

3.5 Conclusions

In conclusion, the first topic of those interviews stated that STI is crucial in everyday research and teaching work and highlighted some decisive, but not always sufficient, tools used in the field.

The second topic managed to focus our attention on the major issue of the evaluating process in IL: due to information overload, it became more and more decisive to develop skills in this direction.

Finally, the third topic, besides reaffirming the evaluation of articles and journals as an important competence in STEM disciplines, made us craft our course as an online group workshop, like those in Belgium, Italy and Latvia, or as an online course in autonomous learning, like those in Portugal and Spain.

These findings helped us in the process of creating our first training courses.



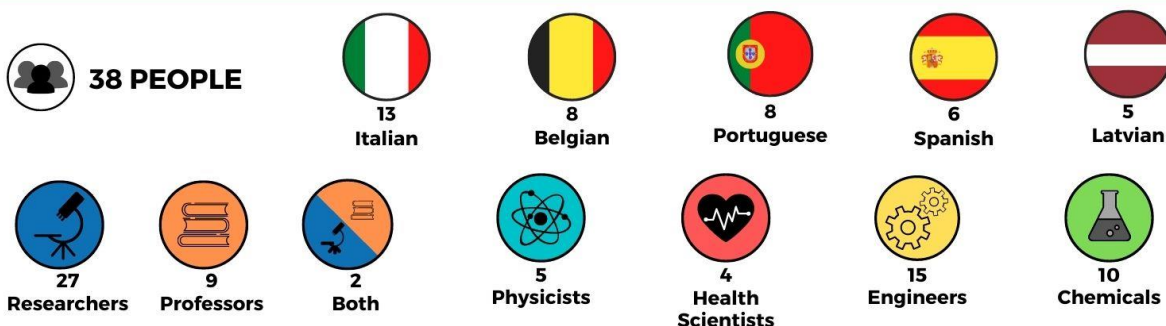
FOCUS GROUPS RESULTS

Co-funded by the
Erasmus+ Programme
of the European Union

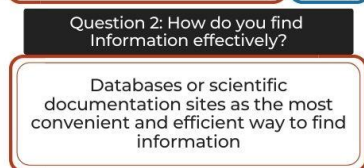
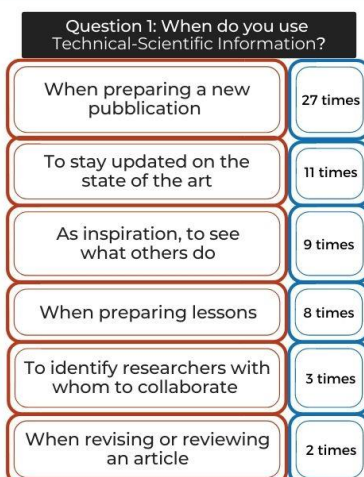


DEEPER INSIGHTS

SAMPLE



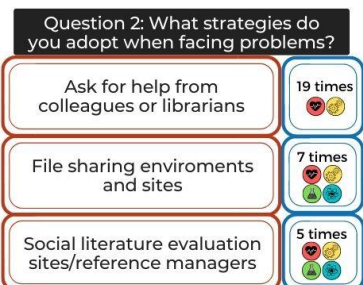
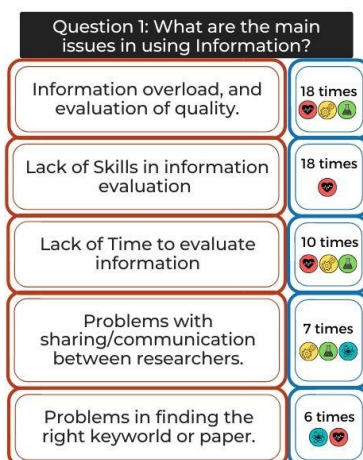
PERCEPTION



OVERALL

Scientific Technical Information is effectively used on daily basis. Databases and documentation sites are great tools but sometimes they are not enough.

ISSUES



LEARNING

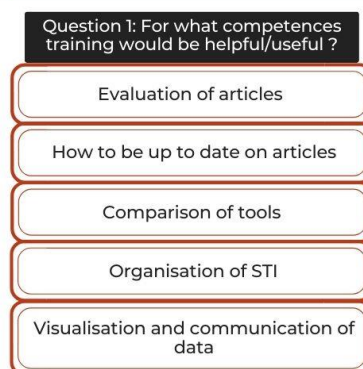


Fig. 2 - Focus groups' results

Chapter 4: Information literacy education for adult learning

4.1 Models for information literacy adult education

Models, standards and frameworks are the main tools with which libraries and professional organisations have structured IL education over the years, in the context of formal and informal adult education.

As suggested by Chevillotte (2005), it is possible to make a distinction between models and curricula. Models are generally studies that describe the process of seeking information, in its different phases and cognitive and methodological dimensions, or theoretical and reflective representations of the interaction process of the individual with the universe of information and documents as a whole. Standards and, more recently, the frameworks are instead descriptive curricula of the course of study that a person must follow in order to be skilled in the use of information.

With the emergence of the technological and digital revolution, many of these documents have been updated or radically revised in the last 20 years and new models have been produced and created.

Despite the diversity of approaches in terms of cognitive, methodological and didactic approaches, the changes introduced have tried to respond to the need to renew the educational role played by libraries, in response to the changes generated by the digital revolution, but also by the fact that the first standards and curricula proposed were very focused on the concept of skills to be acquired, on the linearity of the document research process and on the paper dimension of the information.

The best-known and most cited models in the literature are two: the Information Search Process (ISP) model by C. Kulthau and The Seven Faces of Information Literacy by C. Bruce.

The first model insists on the idea that the bibliographic research process is a process of active construction of the subject, going through six different phases: initiation, selection, exploration, formulation, collection, presentation. The individual goes through different cognitive stages (from ignorance to knowledge), behavioural stages (from uncertainty to security) and affective stages (from confusion and discomfort to clarity and mastery).

The second model starts from a rich phenomeno-graphic research, categorises the complex relationship that each individual builds with information and documents when they use them for own purposes. Then it identifies 'seven faces' that correspond to seven different ways of relating

to the information environment, from the simplest to the most complex. The first face highlights the technological and digital dimension of access to documents (information technology conception); the second privileges the knowledge of the multiplicity of information sources (information sources conception); the third emphasises the process dimension of information searching (information process conception); the fourth focuses on the ability to manage documents for subsequent reuse (information control conception); the fifth highlights the ability to know how to extract knowledge from documents (knowledge construction conception); the sixth underlines the ability to construct knowledge for oneself (knowledge extension conception); the seventh is the ability to build knowledge for others (windows conception).

Another very popular model, born in the educational and non-library fields, is the Big Six model, created by Mike Eisenberg and Bob Berkowitz (see <https://thebig6.org>), which applies a problem-solving approach to the research process and use of information. Although mainly used with children as the target, it has also spread to the adult public. The process outlines six stages, each one divided into two activities, through which anyone can solve problems or make decisions using information.

The circular process starts from the phase of defining the purpose of the research (which includes defining the problem and identifying the information that is needed), to the phase of defining the strategies for finding information (which implies the determination of all possible sources and the selection of the best source), to the access and localisation phase (localisation of the sources and identification of the information within them). Then, it proceeds with the phase of use of the information (which involves the reading and analysis of the identified contents and the extrapolation of the most important information) and summary (organisation of the information collected and presentation of the results). The last phase is aimed at evaluating the process carried out in terms of the effectiveness of the result and the efficiency of the process.

R. Kay and K. Ahmadpour proposed a comparative analysis of some models (ISP, Big Six and I-Learn) on the basis of which they then elaborated a proposal for a framework called the 5Ps, which also has the objective of simplifying the terminology and making it more intuitive for the final user. As pointed out by the authors, the descriptive models of IL in the twenty-first century highlight the shift from the classical librarian perspective, which focuses primarily on seeking or receiving information, to a vision that emphasises the production and presentation of information. The users and final recipients of training are no longer seen as consumers of information only, but in their active role as producers and builders of information and documents and of meanings to give to experiences.

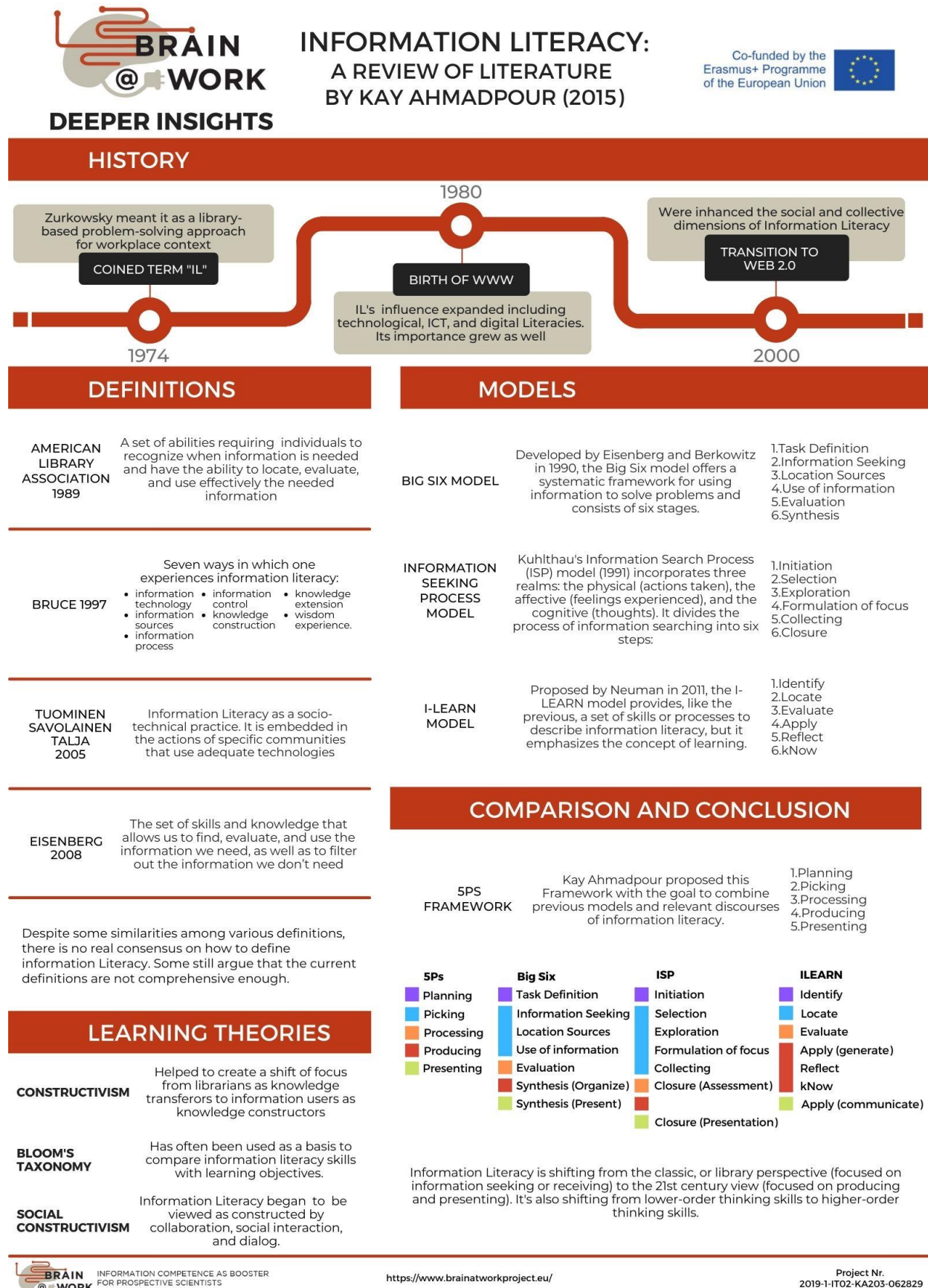


Fig. 3 Information literacy: A review of literature by Kay Ahmadpour (2015)

At the same time, there is a shift and greater attention to higher-order thinking skills. For example, the figure 4 shows that both information processing, which is built on analytical and evaluative skills, and information production, which is based on creative thinking, require higher level thinking skills rather than planning, choosing and presenting.

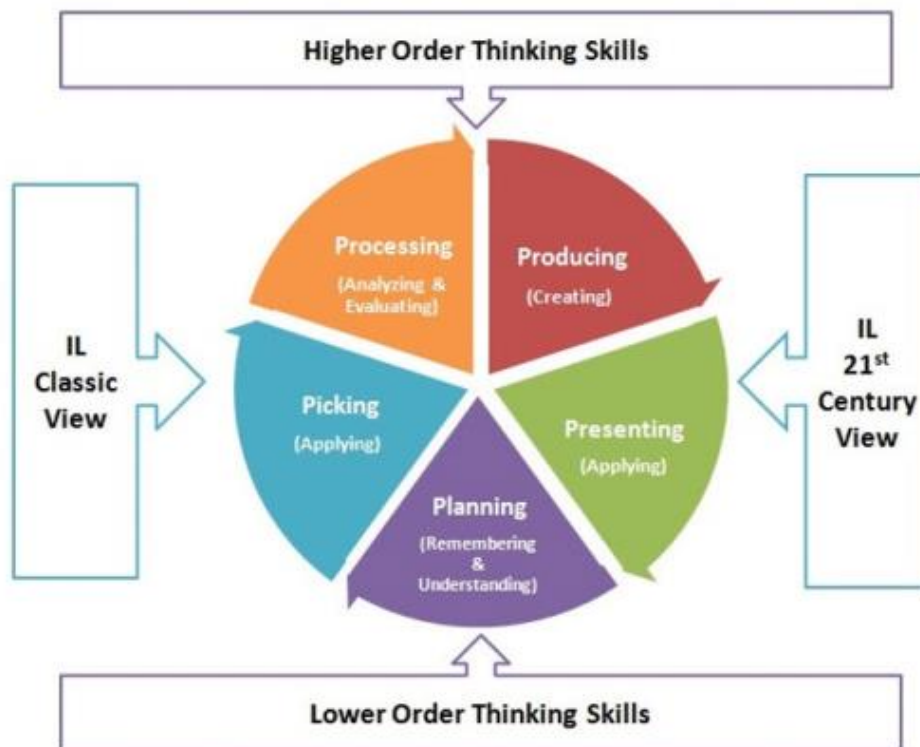


Fig. 4 R. Kay and K. Ahmadpour 5Ps framework

A further approach in this direction, born in 2015 outside the library field, is the metaliteracy model produced by Mackey and Jacobson (see <https://metaliteracy.org/>). This approach aimed precisely at redefining IL by adapting it to the educational challenges and opportunities for exchange and informal learning, which are offered by social media and online communities. The key concept in this approach is that of metacognition, understood as the reflective capacity of the learning process generated in a given context. In order to define him/herself as a ‘metaliterate’, an adult must develop four learning areas: the behavioural one (‘what students should be able to do upon successful completion of learning activities-skills, competencies’); the cognitive one (‘what students should know upon successful completion of learning activities-comprehension, organisation, application, evaluation’); the affective one (‘changes in learners’ emotions or attitudes through engagement with learning activities’); and the metacognitive one (‘what

learners think about their own thinking – a reflective understanding of how and why they learn, what they do and do not know, their preconceptions, and how to continue to learn’).

4.2 Framework and curriculum for information literacy education for adults

In the university field, a variety of curricula and standards have been published for teaching IL, which result from the work of library organisations and associations or individual institutions.

These curricula generally shared the following two characteristics: they were both linear or designed to be carried out in a step-by-step path (progressive or recursive); and neutral or designed to be embedded into the disciplinary curriculum of reference studies at a later time. Many of these documents were revised in the twenty-first century. In summary, the changes generated concerns, first of all, the passage from a linear to a modular structure, the passage from the analogue to the digital context, the idea that the beneficiaries were not only users of the library but more generally all individuals as information users, and more and more producers of knowledge.

At the international level, the most widespread curriculum is the Information Literacy Competency Standards for Higher Education of the American Association of College of Research Libraries, published in 2001. The standards have been deeply revised, due to the strictly behaviourist and prescriptive approach, and in 2015 the **Framework for Information Literacy for Higher Education** was published. The new framework is based on the idea that in every discipline there are threshold concepts that must be acquired and that modify the way in which knowledge is understood. These are, in fact, concepts of learning experiences that open up new perspectives and turn our attention to things we had not noticed before. Once the threshold is crossed, both our practices and attitudes change. Acquiring IL therefore means exploring and crossing the following six frames, displayed in alphabetical order:

- Authority is the result of a construction and is contextual
- Creating information is a process
- Information has value
- Research is an investigation
- Scientific knowledge is a conversation
- Searching is a strategic exploration

It is not the purpose of this report to analyse this new vision in detail, but it is evident that the approach is totally new, less and less oriented to the skills to be achieved and the learning outcomes. On the other hand, it is increasingly focused on the reflective discovery of information and on the metacognitive learning dimension. As stated in the document, the new frameworks arise from the need to orient and respond to the dynamic and often uncertain information ecosystem in which we all work and live. It also intends to make students and future researchers aware of the ever-increasing role and responsibility they have in creating new knowledge, in understanding the

changing dynamics of the information world and in ethically using information, data and scientific knowledge.

In Europe, the best-known model is the **SCONUL Seven Pillars Model** (<https://www.sconul.ac.uk/page/seven-pillars-of-information-literacy>) published by the English association of the same name (Society of College, National and University Libraries) in 1999 and then revised in 2011 and 2015. The new version distinguishes between a core model for the university, based on seven pillars and a series of ‘lenses’, which are specific focuses that aim to deepen a specific disciplinary field or topic or to address specific target users. For each pillar the contents, attitudes and skills that the student must acquire are identified.

The seven pillars of the core model are: identification, purpose, planning, collection, evaluation, management and presentation.

In summary, the model goes from being a linear model to a circular and recursive one. Each pillar can be taught and learned independently and at different levels of study, from novice to expert. Among the published lenses, the model presents one specifically dedicated to researchers who focus more attention on the investigation process, on data, on open access and the ethical use of information.

Other standards, models and frameworks have been developed in Europe, but frequently these are adaptations or development of the American or English model. The **Five Pillar Framework** developed by the University of Liège (https://infolit.be/5PMIS_EN/) is particularly relevant for the purposes of this report, because it is completely focused on the access, use and communication of scientific literature and was specifically aimed at students and PhD students.

Outside the university sphere, in Europe, the **DIGCOMP 2.1 ‘Reference framework for digital skills of citizens’** was published in 2013 by the European Commission and then revised a few years later (<https://digital-skills-jobs.europa.eu/en/actions/european-initiatives/digital-competence-framework-digcomp>), with the aim of providing a tool for developing digital competence in Europe. This competence is meant as one of the eight key competences for lifelong learning that each citizen must acquire and develop throughout their life in order to actively participate in society. The framework proposes an overall picture of digital competence, which is divided into five macro-areas of competence, for a total of 21 skills, and three different levels of mastery. Each competence is described in terms of knowledge, skills and attitudes that each one must acquire. The first area of expertise refers to the skills that generally pertain to information skills, and in particular, includes the following three skills: knowing how to browse, search and filter data, information and digital content; knowing how to evaluate data, information and digital content; and knowing how to manage data, information and digital content.

4.3 Learning strategies for adult information literacy education

The literature on information competence, despite being rich in theoretical approaches and cases, has not frequently focused on the analysis of the most effective learning strategies to be adopted for teaching IL.

When these data emerge, as underlined in some reviews (Kay & Ahmadpour, 2015), these are the three most cited and used approaches: constructivism, social constructivism or connectivism and Bloom's taxonomy.

Constructivism is considered the most widespread approach as it brings out the role of active constructors of meaning that individuals play or should play in relating and using the information and the dimension of independent and self-sufficient apprentices (learners). The constructivist perspective has also helped to create a shift of attention from librarians as sources of knowledge, to users of information as builders of knowledge.

Bloom's taxonomy has often been used as a basis for comparing information skills with learning objectives (for example, Keene et al., 2010; Spring, 2010; Kessinger, 2013). Kessinger (2013), for example, uses the six phases of Bloom's taxonomy to devise a research support framework to improve the information skills of undergraduate students. Spring (2010) parallels Bloom's taxonomy and SCONUL's seven-pillar model in the UK to provide an evidence-based approach to teaching and understanding IL.

According to social constructivism, while the individual mind is important in the construction of meaning, social contexts and interaction with other minds is essential (Savolainen, 2009). Instead of a process of building meaning based on the individual, a process of building social meaning becomes prevalent, and the focus shifts to community and conversations (O'Farrill, 2010). With Web 2.0 environments, technology is used collaboratively to build personal meaning (Tuominen et al., 2005). As collaboration and information sharing became easier, communities of practice were formed, and studies began to include communities of practice in IL research (Abdi, Partidge & Bruce, 2013). IL has also begun to be associated with the notion of social co-construction (Lloyd, 2010). With this new understanding, IL has begun to be seen as constructed from collaboration, social interaction and dialogue, as increasingly clear in the models and curricula of recent years.

4.4 Conclusions

There is a variety of models, standards and frameworks produced both in university and extra-university settings that can guide education practices in IL. Many have been revised to respond to the changing demands of the digital context, where information and documents are produced and received, whereas others have emerged in recent years.

In general, the new approaches primarily consider the recipients not only as users of the library but more generally as users of information. They consider them users of all information, meant as any type of textual, visual or audio content, in any published format. Then, they enhance the role of individuals as producers of content derived from the new digital context, by giving more and more importance to the critical and methodological dimension of IL in comparison to more prescriptive and behavioural approaches, which were more common in the first models.

Both in relation to the models and frameworks, and in relation to the teaching strategies adopted, the need regards the following items:

- to avoid reducing the teaching/learning process to a list of observable and evaluable behaviours;
- to reduce the individual dimension of learning and raise the collaborative and social dimension;
- to overcome the passive representation of the student in favour of a vision of an individual who constructs an own knowledge;
- to avoid imagining information as a static object that must be found and used, but as an element of a contextual and situated relationship.

Chapter 5: Bibliography

5.1 Introduction

This chapter summarizes the outcomes of literature-based research undertaken by BRAIN@WORK project team as a contribution to the Comparative report on “Teaching information competences in a digital world for future professionals: state of the art of strategies and methodologies for STEM in Europe”.

The research specifically addressed two key issues:

1. What are the information literacy education experiences carried out in the five project countries specifically addressed to future or young researchers in the field of STEM disciplines?
2. What are the main characteristics of these experiences?

Published literature, both in English and in the languages of the participating countries, spanning in the first decades of the 21st century (period of 2000-2019) was examined in relation to these two questions.

5.2 Methodology

Bibliographic research was carried out in March 2020 in the following bibliographic databases: Web of Science, Scopus, LISTA, Library, Information Science & Technology Abstracts, ERIC Institute of Education Sciences. National repository and using the Bielefeld Academic Search Engine. The research question was constructed using the following set of keywords adapted to the search strategies allowed in the different databases:

1. IL, information competence, information skill, information capability, personal information management, digital literacy, data literacy, media information literacy, visual literacy, copyright literacy, evidence-based medicine;
2. postgraduate student, doctoral student, researcher, scientist, professor
3. education, training, professional updating, life-long learning

After the withdrawal of duplicates, the initial selection, conducted by applying filters by year (2000-2019), type of document (articles or reviews), and language when allowed (English, French, Latvian, Italian, Portuguese, Spanish), resulted in 390 scientific articles and reviews remained for analysis of title and abstract.

The work of analysis and subsequent exclusion of irrelevant documents was conducted collaboratively online using Zotero bibliographic management software. The complete bibliography of the BRAIN@WORK group is accessible online to authorized users at the following link: <https://www.zotero.org/groups/2416141/brainatwork/library>.

Firstly, two examiners assessed the documents to check whether they met the inclusion criteria described in the table 4 below.

Tab. 4 - Inclusion Criteria

	INCLUSION CRITERIA
Population	University students only postgraduate or doctoral students Academic and non-academic researchers (researchers, academic professors, scientists, etc.)
Discipline	Sciences, Technology, Engineering and Mathematics (STEM disciplines)
Type of Study	Primary/Original Research Case Study Methodological study Literature/Narrative Review
Countries	BELGIUM, ITALY, LATVIA, PORTUGAL, SPAIN

A set of 136 documents was selected for a more in-depth analysis of the contents (introduction, methodology, results), distributed by country according to the following percentages: 39% Belgium, 4% Latvia, 18% Italy, 23% Portugal, 16% Spain. Then the analysis was conducted by each country and a total of 95 documents were excluded. The final 41 selected studies were summarized in an overview of national experiences in Chapter 2 of this report.

5.3 Selected references

1. Adriaenssens J, Benahmed N, Eyssen M, Paulus D, Mertens R. (2018). Towards an integrated evidence-based practice plan in Belgium – Part 1: literature, Belgian situation and end-user needs. Health Services Research (HSR). Brussels: Belgian Health Care Knowledge Centre (KCE). KCE Reports 291. D/2018/10.273/12.
2. Andrade, I., & Prates, M. M. (2010). Information Literacy strategic project at Nova: maximizing how to find, get, use and cite scholarly information. Retrieved from <http://www.unica-network.eu/sites/default/files/Andrade-Prates.pdf>
3. Andrade, I., Camotim, N., Correia, M. A., Duarte, R., Lopes, S., Marques, A., Roxo, A., & Story, S. (2015). O curso de Literacia da Informação da Escola Doutoral da NOVA. Actas do Congresso Nacional de Bibliotecários, Arquivistas e Documentalistas, 0(12), Retrieved from <https://www.bad.pt/publicacoes/index.php/congressosbad/article/view/141>
4. Andretta, Susie Information Literacy: developing the reflective practitioner., 2004. In 5th Annual Conference of the LTSN Centre for Information and Computer Sciences, Belfast (UK), 31st August - 2nd September 2004. [Conference paper]
5. Basili, C. (2008). Information literacy at the crossroad of education and information policies in Europe. Istituto di Ricerca sull'Impresa e lo Sviluppo, Roma.
6. Basili, C. (2011). A Framework for Analyzing and Comparing Information Literacy Policies in European Countries, pp. 395-418 in: Library Trends, Volume 60, Number 2, Fall 2011 - Information Literacy Beyond the Academy, Part I: Towards Policy Formulation John Crawford, Issue Editor
7. Bawden, D. (2001, March). Information and Digital Literacies: A Review of Concepts. *Journal of Documentation*, No. 57, 218-259.
8. Blondeel, S. (2018). Les Bibliothèques universitaires dans le monde des MOOCs. Bulletin des Bibliothèques de France, (16), 58–69. Recuperato da <http://bbf.enssib.fr/consulter/bbf-2018-16-0058-008>
9. Brydges, S. (2016). Chemistry in Context: Integrating Chemical Information Literacy, Scientific Writing, and Contemporary Issues in the First-Year Undergraduate Curriculum. In Integrating Information Literacy into the Chemistry Curriculum (pp. 105-120). American Chemical Society.
10. Brinken, H., Kuchma, I., Kalaitzi, V., Davidson, J., Pontika, N., Cancellieri, M., Correia, A., Carvalho, J., Melero, R., Kastelic, D., Borba, F., Lenaki, K., Toelch, U., Zourou, K., Knoth, P., Schmidt, B., & Rodrigues, E. (2019). A Case Report: Building communities with training and resources for Open Science trainers. *LIBER Quarterly*, 29(1), 1–36. Retrieved from <https://doi.org/10.18352/lq.10303>
11. Brown, C. M. (1999). Information literacy of physical science graduate students in the information age. *College & Research Libraries*, 60(5), 426-438.
12. Bruce, C. (1997). *The Seven Faces of Information Literacy*. Seven Faces of *Information Literacy*. AULSIB Press, Adelaide Auslib Press
13. Bruce, C. (2004) Information Literacy as a Catalyst for Educational Change. A Background Paper. In Danaher, Patrick Alan, Eds. Proceedings “Lifelong Learning: Whose responsibility and what is your contribution?”, the 3rd International Lifelong Learning Conference, pages pp. 8-19, Yeppoon, Queensland.

14. Buoso, P. (2008). La biblioteca come ambiente formativo: l'esperienza della Libera università di Bolzano. In C. Gamba, & M. L. Trapletti, (A c. Di). (pp. 251-269). Biblioteche & formazione: Dall'information literacy alle nuove sfide della società dell'apprendimento. Milano: Bibliografica.
15. Campbell, S. (2004). Defining Information Literacy in the 21 century. IFLA 70th Conference Retrieved September 21, 2004, web site: <http://www.ifla.org/IV/ifla70/papers/059e-Campbell.pdf>.
16. Cheuk, B. (2002) 'Exploring information Literacy in the Workplace: A Process Approach', in C. Bruce and P. Candy (eds.) Information Literacy Around the World: Advances in Programs and Research, pp. 177—91. Wagga Wagga , Australia: Centre for Information Studies, Charles Sturt University .
17. Cheuk, B. (2008). Delivering business value through information literacy in the workplace. Libri, 58, 137-43.
18. Chevillotte, S. (2005). Bibliothèques et Information Literacy: un état de l'art. "Bulletin des bibliothèques de France (BBF)", 2005, n° 2, p. 42-48. En ligne : <https://bbf.enssib.fr/consulter/bbf-2005-02-0042-007> ISSN 1292-8399
19. Crawford, J. & Irving, C. (2009). Information literacy in the workplace: A qualitative exploratory study. Journal of Librarianship and Information Science, 41, 29-38
20. De Meulemeester, A. (2013). The "Information Literacy Self-efficacy Scale" and the Medical Curriculum at Ghent University. In S. Kurbanoglu, E. Grassian, D. Mizrachi, R. Catts, & S. Špiranec (A c. Di), Worldwide Commonalities and Challenges in Information Literacy Research and Practice (pagg. 465–470). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-03919-0_62
21. De Meulemeester, A. (2018). Information literacy self-efficacy within a medical curriculum: research conducted in 2011-2016 at Ghent University. Recuperato da <http://hdl.handle.net/1854/LU-8611463>
22. De Meulemeester, A., & Buysse, H. (2014). Progress Testing of Information Literacy versus Information Literacy Self-Efficacy in Medical Students. In S. Kurbanoglu, S. Špiranec, E. Grassian, D. Mizrachi, & R. Catts (A c. Di), Information Literacy. Lifelong Learning and Digital Citizenship in the 21st Century (pagg. 361–369). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-14136-7_38
23. De Meulemeester, A., Peleman, R., & Buysse, H. (2018). Medical Students' Information Literacy Self-efficacy: Longitudinal Study-Protocol Covering a Whole Medical Curriculum. Communications in Computer and Information Science, 810, 419–429. https://doi.org/10.1007/978-3-319-74334-9_44
24. De Meulemeester, A., Buysse, H., & Peleman, R. (2018). Development and validation of an information literacy self-efficacy scale for medical students. Journal of Information Literacy, 12(1), 27–47. <https://doi.org/10.11645/12.1.2300>
25. De Meulemeester, A., Schietse, B., Vermeeren, B., Ghesquière, E., Declève, G., Buysse, H., Pauwels, N. (2018). Current and future directions in Belgian medical and health sciences librarianship: a user-tailored approach. Health Information and Libraries Journal, 35(4), 336–340. <https://doi.org/10.1111/hir.12237>
26. De Meulemeester, A., Peleman, R., & Buysse, H. (2019). Impact of Purposefully Designed Learning Activities in the Case of Information Literacy Self-Efficacy. Communications in

- Computer and Information Science, 989, 282–291. https://doi.org/10.1007/978-3-030-13472-3_27
27. De Meulemeester, A., De Maeseneer, J., De Maeyer, S., Peleman, R., & Buysse, H. (2019). Information Literacy Self-Efficacy of Medical Students: A Longitudinal Study. In *Communications in Computer and Information Science* (Vol. 989, pagg. 264–272). https://doi.org/10.1007/978-3-030-13472-3_25
28. De Saulles, M. 2007. Information literacy amongst UK SMEs: an information policy gap. *Aslib Proceedings*, 59, 68-79.
29. Dominguez-Aroca, M.-I. (2017). The library and informational competences in the curriculum of students of Sciences, Medicine, and Health Sciences of the University of Alcala, Spain. *Profesional De La Informacion*, 26(3), 516–524. <https://doi.org/10.3145/epi.2017.may.18>
30. Durieux, N., Maillart, C., Donneau, A.-F., & Pasleau, F. (2018). Controlled before-after study to evaluate change in evidence-based practice of speech and language therapy students. *Health Information & Libraries Journal*, 35(3), 213–226. <https://doi.org/10.1111/hir.12224>
31. Eyre, J. (2012). Context and learning: the value and limits of library-based information literacy teaching. *Health Information and Libraries Journal*, 29, 344-348
32. Fernández-Luque, A. M., Cordón-García, J. A., & Gómez-Díaz, R. (2017). Digital competences in the curriculum of postgraduate studies of health professionals. The role of the librarian as trainer in formative programmes (Vol. Part F132203). *Presentato al ACM International Conference Proceeding Series*. <https://doi.org/10.1145/3144826.3145384>
33. Ferrari, Anusca & Punie, Yves & Redecker, Christine. (2012). Understanding digital competence in the 21st century: An analysis of current frameworks. *21st Century Learning for 21st Century Skills*. 79-92.
34. Frascchetta, S., & Moroni, I. (2017). Formare gli utenti, dall'aula all'e-learning. *Biblioteche oggi*, 35(0), 26–34. <https://doi.org/10.3302/0392-8586-201707-026-1>
35. Fjällbrant, N. (2000), "Information literacy for scientists and engineers: experiences of EDUCATE and DEDICATE", *Program: electronic library and information systems*, Vol. 34 No. 3, pp. 257-268. <https://doi.org/10.1108/EUM00000000006933>
36. Gardner, D. P. (Ed.). (2000). *Learning at work: Tennessee profiles in workplace adult basic education*. Center for Literacy Studies, The University of Tennessee/Knoxville. Retrieved from http://www.cls.utk.edu/pdf/learning_at_work.pdf
37. Goad, T. W. (2002). *Information literacy and workplace performance*. Westport, CT: Quorum Books.
38. González-Fernández-Villavicencio, N., Domínguez-Aroca, M.-I., & Calderón-Rehecho, A. (2013). State of the Art of Information Literacy in Spanish University Libraries and a Proposal for the Future. In S. Kurbanoglu, E. Grassian, D. Mizrachi, R. Catts, & S. Špiranec (A c. Di), *Worldwide Commonalities and Challenges in Information Literacy Research and Practice* (pagg. 288–294). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-03919-0_37
39. Hannes, K., Vandersmissen, J., Blaeser, L. D., Peeters, G., Goedhuys, J., & Aertgeerts, B. (2007). Barriers to evidence-based nursing: a focus group study. *Journal of Advanced Nursing*, 60(2), 162–171. <https://doi.org/10.1111/j.1365-2648.2007.04389.x>

40. Hannes, K., Claes, L., & Group, T. B. C. (2007). Learn to Read and Write Systematic Reviews: The Belgian Campbell Group: Research on Social Work Practice. <https://doi.org/10.1177/1049731507303106>
41. Hepworth, M., & Smith, M. (2008). Workplace information literacy for administrative staff in higher education. *Australian Library Journal*, 57, 212-36.
42. Inskip, C; (2014) Information literacy is for life, not just for a good degree: a literature review. (Information Literacy Project 26). Chartered Institute of Library and Information Professionals (CILIP): London, UK
43. Kay, R. UOIT, Canada; Ahmadpour K. University of Ontario Institute of Technology, Canada. EdMedia + Innovate Learning, Jun 22, 2015 in Montreal, Quebec, Canada ISBN 978-1-939797-16-2 Publisher: Association for the Advancement of Computing in Education (AACE), Waynesville, NC
44. Keene, Dr. (2010). Mapping Student Information Literacy Activity against Bloom's Taxonomy of Cognitive Skills. *Journal of Information Literacy*. 4. 10.11645/4.1.189.
45. Kessinger, P. (2013). Integrated instruction framework for information literacy. *Journal of Information Literacy*, 7(2), 33-59.
46. Kirton J. & Barham L. (2005) Information literacy in the workplace, *The Australian Library Journal*, 54:4, 365-376, DOI: 10.1080/00049670.2005.10721784
47. Klusek, L. & Bornstein, J. (2006). Information literacy skills for business careers: Matching skills to the workplace. *Journal of Business & Finance Librarianship*, 11, 3-21.
48. Krumina, L., & Parsova, L. (2010). Multilevel system of information literacy education in Latvia. Case study.
49. Lau, Jesus. (2006). Guidelines on Information Literacy for Lifelong Learning.
50. Lloyd, A. (2003) 'Information Literacy: The Metacompetency of the Knowledge Economy, an Exploratory Paper', *Journal of Librarianship and Information Science* 35 (2): 87—92.
51. Lloyd, A. (2010). Information literacy landscapes: information literacy in education, workplace and everyday contexts. Oxford: Chandos.
52. Lloyd A, Williamson K. (2008). Towards an understanding of information literacy in context: Implications for research. *Journal of Librarianship and Information Science*. 2008;40(1):3-12. doi:10.1177/0961000607086616
53. Lloyd A. (2011). Trapped between a Rock and a Hard Place: What Counts as Information Literacy in the Workplace and How is it Conceptualized? *Library Trends*, 60, 277-296.
54. Lopes, Carlos. 2015. «As competências da literacia da informação integradas nos curricula académicos». 12o Congresso Nacional BAD 1–9. Retrieved from <https://www.bad.pt/publicacoes/index.php/congressosbad/article/view/1462>
55. Lucchini, P. (2007). La formazione dell'utente: metodi e strategie per apprendere la biblioteca. Milano: Bibliografica.
56. Mamoli, F. (2005). L'esperienza di Parma sulla formazione degli utenti. *Bibliotime*, VIII (1). Recuperato da <https://www.aib.it/aib/sezioni/emr/bibtime/num-viii-1/mamoli.htm>
57. O'Brien, Kelsey & Forte, Michele & Mackey, Thomas & Jacobson, Trudi. (2017). Metaliteracy as Pedagogical Framework for Learner-Centered Design in Three MOOC Platforms: Connectivist,

- Coursera and Canvas. Open Praxis. 9. 267. 10.5944/openpraxis.9.3.553.
58. O’Farrill, R. T. (2010). Information literacy and knowledge management at work: Conceptions of effective information use at NHS24. *Journal of Documentation* 66, 706-733. doi: 10.1108/00220411011066808
59. Owusu-Ansah, E. (2003). *Information Literacy and the Academic Library: a Critical Look the Controversies Surrounding It*. *The Journal of Academic Librarianship*, No. 29, pp.219-230.
60. Paiano, T. (2016). Information literacy e mondo del lavoro: un connubio possibile anche in Italia? *AIB studi*, 56(2). <https://doi.org/10.2426/aibstudi-11451>
61. Paidere, I., & Putniņa, A. (2013). Informācijpratības pārbaudes un vērtēšanas metodes=Methods of examination and evaluation of information literacy.
62. Perrault, A. (2007). American competitiveness in the Internet age: Information Literacy Summit, October 16, 2006, Washington, DC. Retrieved from <https://docs.google.com/fileview?id=0B3SNP9j56rIODA2MTI3MDktOTE4My00MjkwLWJhMTgtOWZkYjI4MGQzZTVj&hl=en&pli=1>.
63. Pinto, M., Fernández-Ramos, A., Sánchez, G., & Meneses, G. (2013). Information Competence of Doctoral Students in Information Science in Spain and Latin America: A Self-assessment. *The Journal of Academic Librarianship*, 39(2), 144–154. <https://doi.org/10.1016/j.acalib.2012.08.006>
64. Pochet, B., Lepoivre, P., & Thirion, P. (2013). Littérature scientifique et formation à l’information, la situation des bioingénieurs à Gembloux Agro-Bio Tech (ULg). *Biotechnologie, Agronomie, Société et Environnement*, 17(1), 1–13.
65. Pochet, B., Blondeel, S., Collette, C., Delbushaye, T., Deweer, L., Durieux, N., Thirion, P. (A c. di). (2015). Former aux compétences informationnelles à l’heure du Web 2.0 et des discovery tools - Actes du colloque du 18 mai 2015. Bruxelles: ARES/BICfB.
66. Pola, M. (2018). “Preoccupato per la tesi di laurea?” *Biblioteche oggi*, 36(0), 15–26. <https://doi.org/10.3302/0392-8586-201805-015-1>
67. Príncipe, Pedro, Antónia Correia, Carla Marques, e Eloy Rodrigues. 2018. «FIT4RRI: importância da ciência aberta na RRI». *Actas do Congresso Nacional de Bibliotecários, Arquivistas e Documentalistas* 0(13). Retrieved from <https://www.bad.pt/publicacoes/index.php/congressosbad/article/view/1811>
68. Sayyad Abdi, E., Partridge, H., & Bruce, C. (2013). Website designers: how do they experience information literacy?. *The Australian Library Journal*, 62(1), 40-52.
69. Savolainen, R. (2009). Small world and information grounds as contexts of information seeking and sharing. *Library & Information Science Research*, 31,38-45.
70. Sicilia, M.-A., Rózewski, P., Royo, C., García-Barriocanal, E., Kieruzel, M., Uras, F., Hamill, C. (2018). Digital skills training in Higher Education: Insights about the perceptions of different stakeholders (pagg. 781–787). Presentato al ACM International Conference Proceeding Series. <https://doi.org/10.1145/3284179.3284312>
71. Sokoloff, J. (2012). Information Literacy in the Workplace: Employer Expectations. *Journal of Business & Finance Librarianship*, 17, 1-17.
72. Spring, Hannah. (2010). Theories of learning: Models of good practice for evidence-based information skills teaching. *Health information and libraries journal*. 27. 327-31.

73. Thirion, P., & Pochet, B. (2003). Information Literacy (IL) in Belgium. An overview by the EduDOC Group. In B. Carla (A c. Di), *Information literacy in Europe: a first insight into the state of the art of information literacy in teh Européan Union* (Vol. 1–II, pagg. 12–24). Roma: Italian Research Council. Recuperato da <http://hdl.handle.net/2268/500>
74. Thirion, P., & Pochet, B. (2009). Information Literacy in Students Entering Higher Education in the French Speaking Community of Belgium: lessons learned from an evaluation. *IFLA Journal*, 5(2), 152–170. <https://doi.org/10.1177/0340035209105671>
75. Tuominen, K., Savolainen, R. & Taija, S. 2005. Information literacy as a sociotechnical practice. *Library Quarterly*, 75, 329-345.
76. Uribe-Tirado, A., & Girlesa Uribe, A. (2012). Information literacy in Spanish universities. Degree of implementation based on library-LRC Website information. *Revista Espanola De Documentacion Cientifica*, 35(2), 325–345. <https://doi.org/10.3989/redc.2012.2.873>
77. Uribe-Tirado, A., Pinto, M. (2017). «75 Lessons Learned for Enhancing Information Literacy Programs From Ibero-America to Universities Worldwide». *Information and Learning Sciences* 118(9–10):471-89. Retrieved from <https://www.emerald.com/insight/content/doi/10.1108/ILS-04-2017-0032/>
78. Uribe-Tirado, A., Pinto, M., & Machin-Mastromatteo, J. D. (2017). Developing information literacy programs: Best practices from Latin America, Spain and Portugal. *Information Development*, 33(5), 543–549. <https://doi.org/10.1177/0266666917728470>
79. Valle Santos, M., & Mayoral, R. M. (2018). Information literacy in managers' education. *Journal of Business and Finance Librarianship*, 23(2), 167–182. <https://doi.org/10.1080/08963568.2018.1510253>
80. Van Borm, J., Dujardin, M. (2001). Consortia for electronic library provision in Belgium, *LIBER Q*, 11 (1), 14-33.
81. Vezzosi, M. (2006). Information literacy and action research: An overview and some reflections. *New Library World*, 107(7/8), 286–301. <https://doi.org/10.1108/03074800610677272>
82. Vezzosi, M. (2009), "Doctoral students' information behaviour: an exploratory study at the University of Parma (Italy)", *New Library World*, Vol. 110 No. 1/2, pp. 65-80. <https://doi.org/10.1108/03074800910928595>
83. Vilar, P. & Juznic, P. & Bartol, T. (2015). Information behaviour of Slovenian researchers: Investigation of activities, preferences and characteristics. *Information Research*. 20.
84. Virkus, S. (2003) 'Information Literacy in Europe: A Literature Review', *Information Research* 8 (4): 1—102.
85. Weiner, S. (2011). How information literacy becomes policy: An analysis using the Multiple Streams Framework. Accepted for publication in *Library Trends*.
86. Zurkowski, P. (1974) *The Information Service Environment Relationships and Priorities*. Related Paper No. 5.



INFORMATION COMPETENCE AS BOOSTER
FOR PROSPECTIVE SCIENTISTS

COMPARATIVE REPORT 2022

Co-funded by the
Erasmus+ Programme
of the European Union



BRAIN @ WORK is co-funded by the Erasmus + Program of the European Union.

This project has been funded with support from the European Commission.

This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Intellectual Output 1

Project Nr. 2019-1-IT02-KA203-062829

CUP: B54I19001980006

<https://www.brainatworkproject.eu/>