



*JITA: JH. Digital Preservation.*

## **COMPETENCIES FOR PRESERVATION AND DIGITAL CURATION**

COMPETÊNCIAS PARA A PRESERVAÇÃO E CURADORIA DIGITAIS

HABILIDADES PARA LA PRESERVACIÓN DIGITAL Y LA PRESERVACIÓN

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### **RESUMO**

A Ciência da Informação, ao longo de sua existência, tem sido um campo multi e interdisciplinar, assim como tem sofrido alterações constantes, dado seu objeto de estudo: a informação. Uma vez que este elemento não é estático e está cada vez mais ligado à tecnologia da informação, tem-se visto um desafio surgir: como garantir a permanência das bibliotecas digitais? De que maneira se pode afiançar que os *terabytes* gerados com cada vez mais velocidade, e nos mais variados formatos, estarão disponíveis e plenamente passíveis de uso ao longo do tempo? Este é um desafio que os profissionais da Ciência da Informação estão sendo provocados a resolver, no processo das chamadas preservação e curadoria digital. Assim, esse artigo objetiva levantar as competências que o profissional da informação deverá ter para efetivar o processo de preservação e curadoria digital. O artigo discute o aparecimento das profissões (sob a ótica da Sociologia), a necessidade do trabalho para a realização do ser humano (Psicologia) e as proficiências dos que exercem o ofício da Ciência da Informação para garantir a preservação de informações digitais nas unidades de informações.

**PALAVRAS-CHAVE:** Ciência da Informação. Competência profissional. Curadoria digital. Preservação digital. Profissões.

### **ABSTRACT**

Information Science, throughout its existence, has been a multi and interdisciplinary field, and has undergone constant change because of its object of study: information. Seen that this element is not static and is increasingly linked to information technology, we have witnessed a challenge arise: how to ensure the permanence of digital libraries? How to secure the terabytes generated with increasing speed, and in various formats, will be available and fully capable of use over time? This is a challenge that Information Science professionals are being challenged to solve in the process of so-called digital preservation and curation. Thus, this article aims to raise the skills that the information professional must have to carry out the process of preservation and digital curation. The article discusses the emergence of professions (from the perspective of Sociology), the need to work for the realization of the human being (Psychology) and proficiencies of exercising the office of Information Science to ensure the preservation of digital information in information units.

**KEYWORDS:** Digital Curation. Digital preservation. Information Science. Professional competencies. Professions.

### **RESUMEN**

La Ciencia de la Información, a lo largo de su existencia, ha sido un campo multi e interdisciplinario, y ha experimentado un cambio constante desde su objeto de estudio: la información. Una vez que este elemento no es

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estático y está cada vez más vinculada a la tecnología de la información, hemos visto surge un reto: ¿cómo garantizar la permanencia de las bibliotecas digitales? ¿Cómo pueden asegurar los terabytes generados con el aumento de la velocidad, y en varios formatos, estará disponible y totalmente capaz de usarse con el tiempo? Este es un reto que los profesionales de ciencias de la información tienen de resolver en el proceso de la llamada preservación digital y la preservación. Por lo tanto, este artículo tiene como objetivo aumentar las habilidades que el profesional de la información debe tener para llevar a cabo el proceso de conservación y la preservación digital. El artículo aborda el surgimiento de profesiones (desde la perspectiva de la sociología), la necesidad de trabajar para la realización del ser humano (Psicología) y competencias de ejercer el cargo de la Ciencia de la Información para garantizar la preservación de la información digital en unidades información.

**PALABRAS CLAVE:** Ciencias de la Información. Competencia profesional. Curaduría digital. Preservación digital. Profesiones.

## 1 INTRODUCTION

Information Science (IC) involves various areas and concepts, and its professionals take on different roles in their work routines and, the qualified results, are necessarily linked to competence.

There are concepts and fields that support the acquisition of professional and personal competence. In this article, there will be brought the skills linked to IC; the personal skills (studied by the Psychology) and the ones about education and training of information professionals (IP), which are related to the concept of learning throughout life. We add the issues related to the profession (studied here from the perspective of the Sociology), which contribute much substantiating to the concept of the profession in IC. We will address all these issues, aiming to investigate what is around the expertise for the professional of the IC to operate the digital preservation and curation.

## 2 WORK AND COMPETENCE IN PSYCHOLOGY AND SOCIOLOGY

Psychology studies human beings in their interactions, including work and organizations, in subareas called Organizational and Work Psychology and Psychology of Work and Organizations, resembled expressions, but not with consensual use in the area (GONDIM; BORGES-ANDRADE; BASTOS, 2010, p. 84). In the literature, these expressions alternate, representing the same concept. Here they both will be used interchangeably as a synonym. The Organizational Psychology field studies the work environment and how men act, interact and react with/to work, as well as to which their demands in organizations are.

First, it is necessary to reflect on the difference between employment and labor, from the perspective of the Psychology. Human labor started in the beginning of the species:

[...] in the communities of hunters and gatherers, 8,000 years BC, the incipient agriculture in the Middle East, China, India and North Africa, the slave labor in ancient civilizations and servile relationship in the Middle Ages (...) the most refereed ideas about work in antiquity, in the literature, are certainly those associated with the Greek Athenian thinking, and with slave practices, in the Roman Empire. Literature has rescued the thought of Plato and Aristotle about work. Such classical philosophers extolled idleness (Anthony, 1977; Hopenhayn 2001 cited by BORGES; YAMAMOTO, 2014, p. 28).

The concept of work came to occupy a privileged place in the theoretical reflection space in the last two centuries (BENDASSOLLI; BORGES-ANDRADE, MALVEZZI, 2010). For the psychologists Judge and Kammeyer-Mueller (2012, p. 343), as much part of life is spent at work, it is part of one's identity.

In 1964, Leavitt and Bass (PORTER; SCHNEIDER, 2014) first used the term Organizational Psychology. In 1990, there comes the term Organizational and Work Psychology (O & WT). Other authors use the nomenclature of Psychology of Work and Organizations (PW & O), which can be defined as a sub-area of knowledge and scope of expertise or intervention (BORGES-ANDRADE, PAGOTTO, 2010). There is also the so-called Organizational Behavior (OB), which deals with issues related to commitment, stress, learning, gender and health at work, issues that have become dominant in the area, after 1998 (NEIVA, CORRADI, 2010). Porter and Schneider (2014, p. 2) use the terms Industrial and Organizational Psychology (IOP) and Organizational Behavior (OB) and they teach us that the organizational part of Psychology emerged from the post-war period in 1950. For them, there is no field called Organizational Psychology, and they prefer to use the terms above.

Internationally, Porter and Schneider (2014, p. 12) recently raised the top ten areas for members of the Society for Industrial and Organizational Psychology (SIOP), which are:

1. Testing/assessment (e.g., selection methods, validation, predictors);
2. Coaching/leadership development;
3. Staffing (e.g., recruitment, applicant reactions, selection system design, succession, workforce planning);
4. Leadership;
5. Performance appraisal/feedback/management/goal setting;
6. Organizational performance/change management/downsizing/OD;
7. Research methodology (e.g., surveys);
8. Organizational culture/climate;
9. Job analysis/job design/**competency modeling** (emphasis added);
10. Groups/teams.

In the field of the Sociology of professions, Wilensky (1964, p. 138, cited by ALBERNAZ, 2011) made a historical survey about its arising. According to Albernaz and Abbott (1988), the process that leads to the appearing of a profession binds to the fact that



men began to do the job full-time. Masters in crafts brought up the need for training and practicing, and they opened schools, i.e. before the universities courses existed. Hence, Wilensky points the question of competences arise as an important factor for the professions.

According to Goode (1957, p. 194 cited by ALBERNAZ, 2011) each profession is a community without physical location. With time, the legal protection of the monopoly of skills appears, and a code of ethics is adopted.

Abbott (1988) is a classic author on the area of Sociology of professions, according to Mueller (2004), Walter (2008), Silva (2009) and Albernaz (2011). He divides the professional work in three stages: sort the problem, reflect and argue about it, and act to fix it, or make the diagnosis, inference and treatment. The condition that distinguishes profession occupation is the abstract knowledge of academic characteristics, responsibility of researchers and teachers.

Mueller (2004, p. 26) and Parson (1939, p. 466 cited by ALBERNAZ 2011, p. 127) mention the six attributes that characterize a profession:

1. body of expertise, abstract and systematized;
2. autonomy in professional practice;
3. self-regulation capacity;
4. existence of accreditation procedures;
5. exercise of authority over clients;
6. publication of a code of ethics.

### **3 THE INFORMATION PROFESSIONAL, PRESERVATION AND DIGITAL CURATION**

Analyzing the context of the Information Professional (IP) and his role in digital preservation, the examination of the literature showed that the IP is, and is increasingly more, multifaceted and multidisciplinary and, for this, should seek to keep up to date, innovative and creative. Even if the IP does not “like” to work with technology, he cannot resist to digital literacy.

What defines an information professional? Briefly, and based on the literature, it is the capability of acting in spaces where the information cycle happens, as he comes from multiple formations, but with the core in the after graduate courses in Information Science. It is the professional that, at the same time, mediates and facilitates information for physical or virtual users.

We agree with the statement of Mueller (1989, p. 63), who maintains that the greatest efficiency and social role relevance of the IP would come from his association with other professionals, who also aims to meet individual information needs. In the professional context, to work with preservation and curation of digital information is very up to date, because it is believed that only one type of professional will not be enough and complete too well perform his duties. In the context of the profession and in the digital world, it has required multiple trainings and skills, especially coupled with the computer professionals.

What are the necessary skills for IP teams to make digital preservation and curation? The IP has a rich theoretical training, but still needs to be updated in the technology field, especially regarding to the digital one. This area is one of the most that excels in the profession today, given the evolution of the digital library and the insertion of virtual documents in the collections of information centers. The literature has shown it is essential to training over time (GAMA, 2013). The competence through continuing studies, throughout the professional life, can help ensure the IP not only to be outdated, but also to remain competent in the labor market, once information technologies are in constant and frantic change (BRANDÃO, 2009). Before, a dictum in scientific communication was *publish or perish*, now, we could say that it is *update or perish*.

Investigating the literature, we noticed that many authors in the area were limited to give too general answers about the "new" IP and its roles in digital preservation and curation, here we try to analyze it critically, bringing current issues and new worldviews of the profession.

#### **4 PRESERVATION AND DIGITAL CURATION**

For Hedstrom (1998, p.189), digital preservation is to make "[...] planning, resource allocation and application of methods and technologies to ensure that digital information of continuing value remains accessible and usable [...]".

To Márdero Arellano (2004, p. 43), the DP is one of the greatest challenges of the twenty-first century, even about the storage medium that appears on the market, and then disappears. Ferreira (2006) defines digital preservation as the ability to ensure that digital information remains accessible and with the quality of the authenticity, so that it can be interpreted, in the future, in a different technological platform from the one it was created. The preservation and management of digital objects in Brazil should be a strategic priority for companies, even to the quality of its services. It is a complex process, involving variables that require planning and detailed execution.

On the Portico (2015) system web page, the DP definition is a series of policies and management activities necessary to ensure lasting usability, authenticity, discovery and accessibility of long-term content.

According to Rosenthal *et al.* (2005), the purpose of the DP system is that the information it contains remains accessible to the user, for a long time. By the way, to the OAIS (CCSDS, 2012, p. 1) long-term is a long time enough to get an idea of the impact of a technological change, including support for new media and information data formats held in the OAIS model. It is an indefinite future.

In 2008, Márdero Arellano also referred to the three basic points of a DP: authenticity, reliability and integrity. He summed up the authenticity of the data as the certainty of whom his creator is (p. 135); reliability, linked to certification, is the security of digital data (p. 277); and the integrity, the integrality of the content, with no change or modification in it, to permit continued access.

For Tibbo, Hank and Lee (2008) studies on digital curation began to appear between 2007 and 2008, but long before that, the issue was already questioned. According to Sayão and Sales (2012), digital curation is the management of research data since it starts to be planned, ensuring its preservation for long-term, discovery, interpretation and reuse. It's an expanded concept of digital preservation, once it involves the steps from planning to reuse of research data, but it's still a new and relatively field, with little work about. The DP is already a more defined scenario, although there are those who still mix the two concepts.

For Clatin *et al.* (2014), the definition of digital curation involves:

(...) the overall concept that includes all aspects of the digitized and born digital work on digital cultural heritage: from the input of the document, to the description of the data, storage, dissemination and long-term preservation" (our translation).

Note that although preservation and curation have many similarities, the digital curation process involves a wider process, as it covers the digital preservation since the creation of the data. This encompasses a process that changes the use of research data from how it had been done so far. Original and unpublished data, from researchers and those from surveys, such as those relating to e-science, now have other added values, including allowing the raw data to be reused by other researchers. When the researchers, via Dataverse or other integrated data, provide access to it, others can, ethically, reuse the raw data to make different analyzes and conclusions. Here there is a new idea: the "green" reuse of raw data. Few know that the process of preservation and data curation also reflects the care with the environment.

Digital versions can lead to less discharges and costs (paper, printing, offsets for data collection, sharing of equipment used to collect data, etc.) and optimize the use of the original data (one collection would generate multiple sources for analysis and results). Thus, the costs involved in collecting the data by the first researcher are diluted, if shared with other researchers who will reuse it thereafter.

What the literature advises is that, in Brazil, where the studies are the earliest, the nomenclature that defines the broad digital data processing is very varied, and still not uniform or standardized, below we will bring examples. Terms in Portuguese and English, as digital preservation, digital curation, digital data management, and eScience, among others, as well as the titles for such professionals, are still used interchangeably by some. As an example, we list some studies on skills for professionals involved in the preservation of data, where we present the use of different terms to deal with the same idea. The expression 'digital curator' is used by Abbott (2008) and Kim Warga, Moen (2013, p 68, 78.), data scientists is used by Palmer; Blake; Allard (2012); digital curator, data curator, data manager and eScience professionals, by Kim, Warga, Moen (2013, p. 68, 78), what still shows the "new" phenomenon of protecting digital data and the lack of unification of terms.

## **5 WHAT IS COMPETENCE?**

We will define competence addressing its various aspects. Gilbert (1978 cited by BRANDÃO, 2009) points out that the competence expresses the performance or behavior of the person at work. The S-R movement influenced his proposal, according to which the understanding of the behavior must be linked to the investigation of the relationship between stimuli (S) and responses (R).

Later, Durand (2000) came to lift the components or elements of competence: knowledge, skills and attitudes of the individual. His proposal seems to have been influenced by the S-O-R movement, according to which these affinities need to consider what happens to others (O), which mediates the relationships between S and R. The cognitive approaches, according to Brandão and Borges-Andrade (2007), are based on this theory and assume that the interaction of the person with the environment results in cognitive processes or in the acquisition of knowledge, skills and attitudes. Later, Brandão (2009, p. 11) reaffirms what he said in 2007, calling it the Three Competence Dimensions: knowledge, skills, and attitude.

For Valentim (2002, p. 122) professional competence are "(...) a set of skills, attitudes, theoretical and practical knowledge required to perform a specialized function of a socially recognized and acceptable manner". For her, in the context of information science work, there are two types of skills, the technical-scientific and the managerial. The technical and scientific assume:



- perform the processing of documents in different media, in units, systems and information services;
- store and retrieve information stored in any way for user's units, services and information systems;
- use and disseminate sources, information products and services in different media;
- perform automated procedures;
- plan and build information networks.

For Freitas and Brandão (2006 cited by BRANDÃO, 2009), according to the cognitive approaches, competence is the union of the concepts of knowledge, skills and attitudes, disclosed by the professional performance in an organizational context, adding value to people and organizations.

Professional skills are shown when people act in situations that are faced in organizations and, according to Zarifian (1999), connecting individual attributes and the strategy outlined by the organization. They add economic and social value to individuals and organizations for contributing to the implementation of organizational goals, expressing the social recognition of the ability of people, teams and institutions.

## **6 COMPETENCE AND LIFELONG LEARNING**

Competence also is the result of what the psychologist Dewey (1979) called reflective and critical thinking, engendering people interested in learning to learn, practice based on their life experiences and knowledge acquisition throughout their lives. According to him, it is the synthesis of life's experiences, that each employee carries, producing know-how conscious.

In the physical world, the message is sent from a sender to a receiver, and one way of knowing that the message was received and understood, is when it is answered. In the virtual world the message is sent and received instantly by social subjects (receivers), responsive or not, and interact in real time, radically transforming the relationship between the two worlds, using different technological platforms. Technological competence not only can help make the individual more economically productive, but also meet the expectation of those who postulate the development of analytical skills and critical citizen.

With so much knowledge available in the virtual environment, an issue that cannot be overlooked is the preservation of all this existing content in digital form. Ignoring this is putting at risk of losing this content, every minute, available in digital databases.



IP that intends to pursue and improve their professional competence in the digital world must find a way to make sense of the new forms of communication, dissemination and presentation of digital content. Nowadays, he has to deal with information in various media (text, images, sounds, movies, etc.) in the DP process, which supports have been increasingly diverse.

Learning is not enough, having experience and seeking to recycle is necessary to keep up to date throughout life. Albernaz (2011, p. 83) ensures an urgent need to rethink the profile of the IP, which has expanded its activities, has generated new meanings and has seen its professional space grow, absorbing new features. The author has shown to be essential professional training over time. Enabling through continued studies, throughout professional life, it is what can help ensure that the IP is not deface, and remains competent in the labor market, since information technologies are in constant and frantic change.

## **7 SKILLS FOR PRESERVATION AND DIGITAL INFORMATION CURATION**

In the context of the IC, according to Otlet and La Fontaine, under the ideal of the universal organization knowledge, Internet also adds much to the concept of providing universally assembled content, classified and organized, but that, currently, can lead to the risk of not staying with available access. In all digital content, to organize this information and to prevent its loss against content tampering are very important factors for the study of DP.

DP involves ensuring that digital information remains accessible, with authenticity, integrity and reliability, so that it can, in the future, be fully accessed, interpreted and used, including a different technology platform than the used in its creation. To be sustainable, to be made and kept in operation, it should be a strategic priority for companies, involving good management initiatives and agreements between those responsible for the information unit together with the managers of the institution, where the initiative is going on.

Digitally preserve is to keep “alive” the supporting instruments of the institution, its legal and political value, even to audits. It is having the concern and care to keep alive the collective memory, the documents that make up the history of the places, people, and processes, and over the time, as well as the institution's procedures.

The DP policy instrument is vital in the management of this process, and the policy of a digital library should be more comprehensive and detailed than that of an institutional repository, as it offers a greater range of services than repositories.



What we have today, in relation to technology for DP, will probably be considered bad and inadequate in the future, but today it is something new, it is what is known and what was possible to idealize so far. DP software have a long-term mission, but should be fully usable in the present, because the technology will still change much. The requirements in the choice of software for DP depend on each project to be implemented, the file type to be preserved, the institution's budget and the objective of preserving itself.

It is important to remember that some decisions about DP are necessarily made under conditions of uncertainty about possible technological and political (government and institution) changes, and also in terms of investment priorities in the project and demands of the society. All this can change during the course of the DP project, but practices should be developed to anticipate or solve some of these uncertainties, not to jeopardize the viability of the project.

For Davenport and Prusack (1998 cited by FARIA and CASTRO FILHO, 2014) good digital information professionals need hard skills (structured knowledge, technical skills and professional experience) and soft attributes (sense of cultural, political and personal knowledge).

According to Vendrell and Miranda (1999 cited by FARIA, 2015) there are six types of skills required for the IP: intellectual, practical, interactive, social, ethical and aesthetic competence. In her thesis, Faria (2015, p. 49) cites the most important skills demanded by the labor market within the IC:

- a) knowledge of the information business environment;
- b) ability to work in groups;
- c) relevant distinction and location of the information and relevance of the information;
- d) domain in the use of electronic equipment and in the operation systems or specific software;
- e) knowledge of databases;
- f) familiarity in managing e-business;
- g) theoretical and practical basis on the operation of virtual organizations information;
- h) domain in the logic of indexing and web finder's systems field;
- i) excellence in oral and written communication;
- j) knowledge of infrastructure and information services;
- k) flexibility and versatility;
- l) constant professional development;
- m) ability to understand and manage episodes of different natures and applications;
- n) ability to identify customers and suppliers, and
- o) ability in finding partners.



Valentim (2002) explains that social and political skills bind to attitudes, when wanting to do, to communication and expression; but the managerial and scientific technical skills are related to the procedures. Then, the latter skills are necessary for professional performance. All demand for knowledge, know why to do. She points out that the skills of each competency are not exhausted itself, but were split to better understand what would each of them be.

The information cycle or document flow is the controlling and monitoring of a record (document) in the organization, it is the document process (BUENO, 2013, p. 17). It involves various procedures in the different stages of the documentary cycle (CUNHA, 2009), of which we will highlight those that we consider essential for the digital document and for the role of IP in them:

- Selection and item processing: IP must have a close relationship with information processing standards, as well as to know the standards, formats and web protocols that facilitate the growth of networks. They have to know the rules for description, curation and preservation of digital objects, including the allocation of labels (tags). The IP can take advantage (with criticism) of the collectively assigned tags, which is a collective movement known as tagging or folksonomy (DZIEKANIAK; PACHECO; KERN, 2011 cited by FARIA, 2015). They must also know how and where the contents of the information drive will be stored and retrieved, and how the intercommunication, between the systems involved in the entry and in the retrieval of the database of that unit, will be made.
- Collection development, selection and acquisition: in the past, the IP was largely responsible for this task, and almost exclusively. Currently, that role has changed, and the responsibility is increasingly divided between IP and the users. An example is the e-books, in organizations. Depending on the license of e-books use that IP offers to users, it may no longer be the IP responsibility to exclusively create the organization's collection, as it was, but he will share it with the users, who can choose the kind of material in which they want to access a document, downloading books from sites such licenses permit. Therefore, users not only use the services offered, but also interact, suggest and influence the decisions of the information units. This brings the IP daily question about his new roles in the digital world, not because he did not hold the priority in this choice, but because his liability has increased, once the collection will consist of the preferences of the public who uses e-books, and not only by the IP who technically decides to acquire the e-books.
- bibliographic control: the cataloging and classification processes now have more and more access points, especially if they go through the collective labeling process, searches the data bases are offering more items (in numerical terms



and in depth research) with increasing demand of ontologies devices. The area of linguistics is increasingly approaching to the IC, in order to allow the retrieval of information via FRBR, RDA and AACR3, for example. With FRBR (Functional Requirements for Bibliographic Records) a model of representation and abstraction of reality, information has been more organized, grouped and differently searched. The AACR3 (Anglo American Cataloguing Rules 3) turned into the RDA (Resource Description and Access) due to so many changes that have occurred. In addition, the RDA, cataloging code that contemplate what appeared on the web, it is inferred, it will be the new standard for description and access to resources, designed for the digital world (LIMA, 2015). Consequently, the inclusion of metadata in the documents are differentiated, aiming curating, management, recovery and preservation of digital document.

- Digital Reference: activity that seeks to provide services to remote users, via email or other types of virtual contact, changing a lot the user / library interaction. For Bazin, (In: Accart, 2012, p ix-x), the function of the reference mixes the intellectual competence, technical knowledge and the relationship with the user. What the physical referral service is today may be related to virtual knowledge networks, however, according to Bazin, a paradox arises: the more services are automatized, the more the human component will gain importance, being personalized. We infer that the skills related to empathy, interpersonal skills, learning to deal with people and being able to communicate will far exceed to soften the impersonality of the internet.

- Evaluation: the analysis of the products and services offered in the digital environment are increasingly global, or, as Chaim would say (In: AMARAL, 2007, p 97), transnational. For him, interactivity, personalization, interdependence of organizations and global posture are part of the internet marketing. Both the digital reference step as the assessment should be involved in the process of marketing information. Certainly, an informational product that has undergone a lot of propaganda will have tests, uses and different assessments of who was available to more discreetly. Not all the information units offer concerns to all users and does not even come to their knowledge. Show and evaluate the interest is an important competence of the IP.

There is also the work of Allard, Mack and Feltner-Reichert (2005), which focused their attention on the roles of librarians in the Institutional Repositories (IR), which require DP content. They collect, preserve and distribute digital materials produced in them. Through literature review, the authors raised six areas of knowledge and skills:

1. understand the software;



2. learn to make project planning and management;
3. set of collection;
4. prepare metadata guidance;
5. review the submission (of the institutional repositories);
6. give training to the authors.

The North American Serials Interest Group (NORTH AMERICAN, 2013) defined the skills to electronic resources professionals. The NASIG Core Competencies Task Force (NCCTF) suggests that they are used along with the direction of the American Library Association's Core Competences of Librarianship. The document separates in block the various skills of electronic IP, which involve: the life cycle of electronic resources (NORTH AMERICAN, 2013, p.1), technology (p. 2), research and access (p. 4), effective communication (p. 5), supervision and management (p. 6), trends and personal development and personal qualities (p. 7).

A summary of such skills would be:

a) to have experience in working in digital libraries does not include, professional beginners, new graduates, and employers tend to associate years of experience as skills that are identified in job advertisements;

b) know how to manage the budget of electronic resources, including the terms of less restrictive license during license negotiations between the publisher and the supplier, after all, curation and digital preservation is expensive;

c) ability to apply the principles of organization, knowledge representation and recorded information and, especially, know about preservation metadata;

d) have knowledge and technological skills, theoretical and practical knowledge of hardware and software structures, underlying the provision of access to electronic resources and their interrelationship;

e) have conceptual and practical knowledge of computer hardware and mobile devices, used to access electronic information, and their operating systems;

f) know about network technologies (wired or wireless), standards, protocols and structures such as Z39.50, Open Archives Initiative - Protocol for Metadata Harvesting (OAI-PMH), the emerging techniques of digital preservation and technology, computing networking, use of technologies and their digital preservation tools in information products and services;

g) have knowledge of system architectures, capacity, support options, among others, to library systems involved in the access and preservation of electronic resources.

Fraser-Arnott (2013, p. 6) also made a study of content analysis of 110 job ads, collecting 1,336 skills for Library and Information Science, LIS professionals. Two groups of ads were used for this article: LIS-targeted job boards and Government of Canada internal job postings. The result showed that:

- to the employer: the majority of vacancies was for academic libraries (30%, or 33 posts) or public (21% or 31 posts);
- Educational requirements: 50% requested master's degree in library science or IC, or equivalent degree, the second place was for those who had a doctorate (16%), the following offers were for technical (12%), graduation (11%) and others (11%);
- graduate skills groups were those relating to knowledge and experience, specific job library, information technology skills and transferable skills.

From this previous information it appears that, among libraries, the ones most in need of specialized IP in digital information are the university libraries, which is consistent. It is from there that comes much of the country's research, which requires top researchers with studies like that.

The formation of such professional demands that they are specialized and who has sought specific courses for this (master's, doctoral). Knowledge and experience in libraries and technology skills are vital to the IP.

**Table 1.** Total required competencies, from Library job board advertisements.

Competency Group		Count (n=1336)	Percentage of Total Competencies
1	Knowledge and Experience	194	14.5%
2	Communication*	164	12.3%
3	Personal Qualities*	156	11.7%
4	Information Technology*	147	11%
5	Management and Supervision*	120	9%
6	Teamwork and Interpersonal Skills*	114	8.5%
7	Organizational Skills*	82	6.1%
8	Teaching, Training and Instruction*	63	4.7%
9	Cataloguing and Metadata	60	4.5%
10	Research and Reference*	59	4.4%
11	Problem-Solving and Analysis*	52	3.9%
12	Customer Service*	46	3.4%
13	Program Delivery and Management*	30	0.2%
14	Collection Management	27	2%
15	Professional Development	17	0.13%
16	Library Marketing and Promotion	5	0.04%

Source: Fraser-Arnott (2013, p. 6)

Note in Table 1 that from these 16 raised skills, the data suggest that what the American market wants is IP with personal skills (group 1, 2, 3, 6, 11), technological (4, 13), updated and trained (8, 15), technical (9, 10, 12, 14, 16).

**Table 2.** Total skills required, Government of Canada Job Advertisements.

Competency Group	Count (n=1522)	Percentage of Total Competencies
1. Knowledge and Experience	244	16%
2. Communication	178	11.7%
3. Information Technology/Management of Information/Records management	172	11.3%
4. Teamwork and Interpersonal Skills	141	9.3%
5. Personal Qualities	131	8.6%
6. Research, Problem-Solving and Analysis	866111	7.3%
7. Management and supervision	84	5.5%
8. Financial and resources management	79	5.2%
9. Policies and procedures	65	4.3%
10. Program Delivery and Management	65	4.3%
11. Counseling and recommendations	64	4.2%
12. Human resources and management	46	3.0%
13. Business planning and report	40	2.6%

Source: Fraser-Arnott (2013, p. 7)

The Canadian research, contained in Table 2, compared to the US one, also raises personal skills (groups 1, 2, 4, 5), technological (3, 10); not specifically skills related to upgrading, training and to the technical field; and adds specific skills of a financial nature (8), organizational (9, 13) and human resources management (12).

Note that both surveys raise the personal skills, justifying our study via Psychology of organizations. It also lists generic skills, and even less directly linked to digital professionals, supporting our state that the competencies, for teams, in digital preservation and curation, in the literature is loosely explored, showing why this article is innovative and important for IC.



Two information technology skills appeared in the ads among the ten most requested skills (FRASER-ARNOTT, 2013, p. 9): "Innovative Technologies, Applications and Social Media" and "Business Software" (Microsoft Office). The connection between information management and information technology was strong in the Government of Canada's ads: most of the jobs in this list, which asked educational background on the management of information, included mainly requirements of competence in information technology.

Although information technology skills were a significant competency group to the list of the Government of Canada, no specific competence, related to the technology itself, appeared among the ten skills most requested for that sample (FRASER-ARNOTT, 2013, p. 9).

In the same year, Kim, Warga, Moen (2013) also conducted a survey and identified the skills for the digital curator. For them, digital curation has had an increasingly urgent and important role in the information environment. Thus, there is a need to identify a set of skills for professionals in this growing area. As part of a curriculum development project, funded by the US Institute of Museum and Library Services, they collected from different sources, a total of 173 job ads, published between October 2011 and April 2012, to raise the various types professional skills desirable in the field of digital curation, throughout North America. They examined and analyzed: title, position, type of institution and location, educational background, experience, knowledge, skills and duties. The survey results showed that such professionals are characterized by a complex and rich interaction of various skills and knowledge, and that there are emerging requirements of a skilled labor in the field of digital curation.

Lefurgy (2013) and Kim, Warga, Moen (2012, p 3-4; 2013, p 77-78), who also researched skills for professionals in the digital space, in specialized newspapers ads, highlight the key findings:

- 58% (64 out of 110) of the ads wanted prepared candidates to work in an intensive information technology environment (information technology intensive environment) and not specific. The research raised as possible workplaces libraries, museums and hospitals, among others;
- 66% (73 out of 110 ads) asked for candidates with experience in working in libraries or archives. Of these, 18 ads preferred people with experience in acquisition, curation, preservation and digital content management; 9 asked experience in working with research data; 6 required experience in institutional repository and 3 longed for people with experience in standards and techniques related to digital library technology;



- 58% specified the desired time of professional experience: 13%, at least one year; 27%, at least 2 years; 20% minimum of 3 years; 2 administrative positions called for at least 8 years of relevant experience; the average number was 2.7 years of experience;
- 55% required knowledge of standards such as Dublin Core, METS (Metadata Encoding & Transmission Standard) and MODS (Metadata Object Description Standard) of candidates for the positions;
- 45% of the ads asked skills for project management (project management skills);
- 85% of posts called for applicants with master's degree accreditation by ALA;
- 28% asked Masters in areas other than the IC;
- Generically, it was requested for both practical skills (experience) as much as techniques.

There is no doubt the competence of IP to work with DP passes through the analysis of the managerial competence of the manager and the team skills, which increasingly must rely on specialized personnel. A topic rarely addressed in research, though vital, are the legal aspects involved in the curation and preservation of digital information that is the copyright. Related legal issues, for example, shopping on the web, are already with their defined standards, but not in relation to DP. In Brazil, we have an outdated and restrictive copyright legislation. It is also necessary to evaluate the economic implications of the conservation projects and digital curation, which are expensive, so we should have a sharp technical assessment of sustainability (maintenance) of the project, or it will fail. The development of a DP policy, based on the organization's mission, is an important document as a direction to follow.

## **8 CONCLUSIONS**

This article aimed to identify the professional skills in information services, of those who work in the field of curation and digital preservation; and identify the technological skills of professionals to work with them. By the data collected and commented, we believe to have achieved them, as discussed below.

Issue of great importance is the study of professional and technological expertise for professionals who make preservation and curation of virtual data. The subject should be inserted in the studies developed in the context of digital libraries, the entity responsible for the protection and maintenance of information assurance there deposited in digital media.

Despite the DP theme, already well explored in national and international literature, data curation is still relatively new in Brazil. Moreover, some institutions still lack practical directions on how to operationalize policies and routines directed to digitally preserve items, sometimes leaving it to the backup the "initiative" for preservation. Based on the literature, it



appears that digital libraries and the IC area, as a whole, should better enable their professionals for this specific purpose.

It can be said that competence relates to functionality, it is to put in place a solid base of factual knowledge. Understand the facts and ideas, in the context of the conceptual structure and organize knowledge to facilitate their recovery and application. To define the professional skills for digital information is not so easy or simple because, as shown in the literature, since approximately 2008, i.e., for less than seven years, there have been studies on the subject. What there was before was extracted from contents of the more general area, Administration, which traditionally studied the matter from his point of view, not specifying to the digital context.

About the first objective of the article, to identify the professional skills, in information services, of those who work in the preservation area and digital curation, the cited literature showed that to be competent is important it is important to have professional experience. A market survey on job advertisements found that 66% were asking for experience. In this same path, the North American Serials Interest Group stressed the importance of experience, since beginner professionals often do not work in digital libraries, and employers tend to associate years of experience with the skills to identify in job announcements. May it be emphasized the importance of the competence "experience" with what psychologist John Dewey thought and the subject "learning throughout life".

The article also raised that the market asks for IP with personal, technological, updated and those who look forward to get training and develop financial skills, to observe and manage the organizational and human resource management.

Two questions that accompanied the article were: how to ensure the permanence of digital libraries? How secure can the large volume of digital information generated in various formats, be available and fully capable of use over time? To answer let`s remember that Brazil still lacks courses on DP practices. Such studies that provide digital training should not only cover the area of technology in order to help operate the storage and retrieval of information in digital form, but also train other professionals, such as those linked to information, who can be more qualified to make technical analysis of the information, and thus feed the document databases with metadata.

It is true that the IP should have digital skills that will help them better perform their professional activities, but it is also appropriate to recall that such capabilities are best achieved and maintained with the lifelong learning, search and intermittent production of new knowledge.

We live in a transition period, some authors, have been writing that the IP job is changing, and that he should seek and take on new skills. However, at the national level, the same authors have not made explicit what are these skills. In international studies, the theme it is more mature, as shown, and authors begin to list some of these skills for the professional digital world.

The literature also shows different ways of naming the digital IP as a librarian date, curator date, data manager, eScience professionals, data scientist, data manager, among many other titles. Also, there's a lack of the definition of who is ahead the digital information units, managing them, if they are the librarians, the IT staff (computing), if archivists, well, many are enabled. Who knows the future will come, as suggested by the National Science (2009), with the collaboration between organizations, entities and people to carry forward the management and responsibility for the preservation and curation of digital data.

Although the core of the information profession remains the same, the methods and tools for information delivery needs to change and expand. While maintaining its user-centric approach and its content, professionals increasingly demand advanced knowledge of information technology to deploy their full potential. They must continually look for opportunities to propel them, preparing the IP for its more advanced retrieval, interpretation, synthesis, product development and virtual services on a global scale. Information professionals working with technology have their roots in the past but need to see the future. The skills raised here are the basis for growth in the information age. The IP must recognize and embrace the expanding nature of the technological field and the challenges they face. It is important to remember that success will be next to the choice that brings a happy working life.

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