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DESAFIOS À ORGANIZAÇÃO E ACESSO AO PATRIMÓNIO CULTURAL

U. PORTO DIGITAL MUSEUM PROJECT: TOWARDS CONVERGENCE IN UNIVERSITY'S INFORMATION MANAGEMENT

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ABSTRACT The University of Porto (U.Porto) aims to promote its scientific and cultural heritage through digital media by providing the integrated aggregation of digital information and related metadata which is managed and preserved in archives, libraries, museums and other technology information systems and repositories. This goal is meant to be reached by a theoretical based approach and an information management intervention model – the MGSIU-AP (Active and Permanent University Information System Management Model), which support an intervention toolkit directed to U.Porto Museums. This toolkit is complemented by a learning through projects educational approach, a digital platform which considers, among others, semantics and systems' interoperability, a long term digital preservation repository and an online heritage discovery portal to be developed in the scope of the U.Porto Digital Museum, itself an ongoing interdisciplinary project. This paper describes and discusses the development and subsequent process' model which has an inherent value of standardisation. It considers tools as CIDOC Conceptual Reference Model (CRM), providing an extensible ontology for concepts and information in cultural heritage and museum documentation, the standard SPECTRUM 4.0, describing 21 management procedures in workflow format, along with the policies and minimum features required for the standards to be met. Here will also be presented the work in progress in the field of domain ontologies, framed by an interdisciplinary theoretical approach which crosses information science, information systems and museology in the context of a service-oriented approach. Both goals and issues will also be examined.

KEYWORDS *University heritage, university museum, digital museum, information management, MGSIU-AP.*

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INTRODUCTION

The University of Porto (U.Porto) is a centenary public institution whose Mission is to create scientific, cultural and artistic knowledge, superior education strongly anchored in research, the social and economic recognition of knowledge and the active participation in the development of the communities where it is embedded. Its roots are in scientific and cultural entities of the eighteenth and nineteenth

centuries, and concentrates, in its museological unities, the testimony of the fruitful link between art and research, collecting and teaching, personal introspection and recognition of the world.

Referring to European university museums, Lourenço (2006) pointed to existing critical issues such as facilities, a real diagnosis, the study and interpretation of collections, and Rorschach, in 2012, stressed the management and audiences of the Museum, recognizing the duality of a focus between the internal and the external public. Sharing with Lourenço the focus on the identity, role and mission of the university museum Rorschach stated:

“[...] university museum must never forget that it is in fact a very different kind of beast¹, with a different mission and access to a different, and very strong, array of intellectual resources within its parent university. University art museums can do things that larger municipal museums cannot do, and in my view they ought to do these things, indeed must do them.

What kinds of things? More intellectually risk-taking exhibitions; real engagement of students in creative and meaningful ways that have the potential to nurture life-long lovers and supporters of the arts; meaningful involvement of faculty across disciplines, that can lead to a broader understanding and appreciation of the key importance of art and visual culture in civilizations and cultures throughout human history; and new ways of thinking about collections, including long-term loans from underused collections in larger museums, experimentation with new media in partnership with related university disciplines and resources, and the building of important collections in new areas not yet recognized by the major museums.” (RORSCHACH, 2012).

In fact, the university’ museum distinguishes itself by the unique characteristics of its collection(s): the disciplinary diversity, the richness of the collections typology, the exploration of multiple combinations in educational function, the transdisciplinary investigation and interpretation, either museological or non-museological.

Nonetheless, the identity crisis acknowledged by researchers and professionals has marked the university museums in the last decades. Resulting from and supporting the educational process and the research, these museums see themselves between a custodial and technicist paradigm that roams, in a transverse way, archives, libraries and museums, as well as a tendency to a “public” positioning as cultural service. This means that they tend to move away from the focus on its natural prosumer (producer and consumer) inside the academy to external communities. Meanwhile, academic prosumers increasingly value technological mediation and forget ‘traditional’ spaces which are facing diverse constraints, namely financial.

From a theoretical point of view, the paradigmatic change in emergent scientific areas – such as Information Science (IS) – point to an ongoing shift based on interdisciplinary and trans disciplinary approaches that entail interscientific fields as Information Systems and takes on the Archivistics, Librarianship and even Museology as a branch or applied disciplines of IS. Nevertheless, it is a movement under construction and the increasing complexity of the initiatives in which the university’s cultural and scientific heritage services are involved entails abilities and competencies that go beyond their current framework of resources and expertise and suffers with the absence of a common work environment with shared practices.

¹ Termo aplicado ao Museu universitário por Otto Freundlich, na primeira metade do século XX.

Focusing the mission of University of Porto's museums it is oriented towards the study, representation, description, safeguard, promotion and dissemination of collections of educational and research artifacts. It considers those that are significant to the academy and the scientific universe, to the institutional and "eminent figures" of the University celebration, and to pedagogical and research purposes, through collections specifically conceived with those goals in mind or naturally resulting from them.

Regarding the incorporation of institutional contexts, the U.Porto museums protect material evidence with origin in predecessor institutions to the University since the 18th century until the present, as well as artifacts and information of personal and professional routes provided by teachers, researchers and *alumni*, along with others related to the institution's activities, to the city, to the region, to the country and international interactions.

Thus, U.Porto, as other higher education institutions, faces a unique role in this field pointing to four main levels:

- producing new knowledge, namely epistemological thinking and models (at research and intervention levels);
- empowering its information system and other resources, information/heritage services and technical expertise, through a systemic approach, the integrated management and collaborative practices;
- narrowing the gap between heritage services, technology and classrooms focusing on the dynamic co-production and (re)use of digital contents and tools and providing the opportunity of using as learning projects the real internal and external communities' needs / problems, including heritage ones, encouraging professors, students and researchers to find solutions inside the teaching-learning process and through educational practices, namely assessment works;
- transferring new knowledge to society, enabling the innovation process through platforms, services and activities;
- Building networks.

This paper discuss one of its main issues, the integrated management of the museum' collections representation and description as well as any other related metadata and information (born-digital and digitized) controlled by institutional services, namely information services, either traditional (archives, libraries, museums) or emerging (information management and information technologies).

This goal is meant to be reached, despite information services providers and technological platforms, by a theoretical based approach, an intervention model – the Active and Permanent University Information System Management Model (MGSIU-AP) –, a learning by projects educational concept / platform – the U.OpenLab – and a digital infrastructure which considers, among others, semantics and systems' interoperability, a shared long term digital preservation repository and online discovery portal in the scope of the U. Porto Digital Museum, itself an ongoing interdisciplinary project.

THEORETICAL CONTEXT AND METHODOLOGY

The present paper aims to present a project which emerged within university museums and directed to the university scientific and cultural heritage and its dissemination and promotion through technologies,

by providing the aggregation of existing “digital collections” (archives, libraries and museums’ digital assets and other technological information systems or repositories).

This purpose is rewritten when it considers the ongoing paradigm shift conceptually based on the main concepts of *information*, *communication* and *information system*, reshaping the concept of *heritage* and reviewing the concept of *culture*.

Information and *communication* refer directly to the human capacity of mentally shaping ideas and impressions and share them with the beings of the same species (phenomenon):

Information: In the scope of the trans and interdisciplinary INFORMATION SCIENCE proposed and defended by us, it has got a double semantic functionality. It refers to a human and social phenomenon that includes shaping ideas and emotions (to inform) and the exchange, the effective interaction of those ideas and emotions between human beings (to communicate). It identifies a scientific object: structured set of codified mental and emotional representations (signs and symbols) shaped by social interaction, which can be recorded in any material medium (paper, film, compact disc, magnetic tape, etc.) and, therefore, communicated in an asynchronous and multidirected way (DELTCI, 2017).

Communication: Since the middle of the 20th century this term is mixed in or mistaken for mass journalism, namely in radio, television and, more recently, in multimedia channels, although in the available literature there plenty of examples of the broad spectrum of the use of such a plastic and rich concept. It is a synonym of human and social interaction and assumes, necessarily, the existence of information in the form of messages or contents which are transmitted, shared, in brief, communicated (Dictionnaire encyclopédique des sciences de l’information et de la communication, 1997: 120-123). The term info-communicational completely identifies a human and social phenomenon represented partially or partly by the concepts Information and Communication (DELTCI, 2017).

Conversely, *heritage* is still connected to the descriptive need, inserted in Modernity, to aggregate distinct objects, human and natural, referring to different phenomena, whose common features are conventional (to value the old, rare, handcrafted and pre-industrial are mental and affective dispositions which arise and change with the evolution of the historical process):

Heritage: a construct from the 1800s filled, mostly, with romanticism, nationalism, historicism and reaction to industrialism (capitalist industrial revolution with its successive waves since the 18th century). It is inseparable from the ethnographic and historical-archeological conception of CULTURE that flourished in the 19th century. It encompasses all the material and immaterial goods, identifiers of a culture, of a community, of a people and essential to the ideological cohesion of the Nation State. It is a concept that has gained a strong ideological density and impact through time, which does not help, but hinders instead, its inclusion in a scientific and epistemological field. (DELTCI, 2017)

Culture: Having Edgar Morin’s definition as an inspiration, culture is understood as a human and social dimension with two capitals: a cognitive, mythological and ritual capital (knowledge, beliefs, norms, prohibitions, values) and a technical capital (know-how, practices, rules). The cultural materializations (objects and behaviors) result from the latter, while the former absorbs the strict sense of culture (letters, arts and sciences) accepted by most «schools» and theories and questioned in essays of great value. In a strict sense, culture and information are confused with each other and become synonyms” (DELTCI, 2017).

Finally the concept of *information system*, which cannot be confused with the *technological information system*, although inseparable:

Information System: is a totality formed by the dynamic interaction of the parts, in other words, it has a lasting structure with a flow of states in time. So being, an Information System is constituted by the different types of INFORMATION recorded or not externally to a subject (that each person has in his/her memory is an information of the system), it does not matter what is the MEDIUM (material and technological), in accordance with a structure (producing / receiving entity) extended by the action in the line of time. [...] an ARCHIVE or about a LIBRARY [or a Museum]: one and other are Services and Institutions and in this measure they can be seen as a system; or they are an IS [Information system], which corresponds to all the Information produced / received or incorporated in the System Archive or in the System Library [or in the System Museum] (DELTCI, 2017).

The scientific and theoretical bases point to a new informational paradigm and a convergence based on a systemic, informational and disciplinary perspective of university information system, comprehending Museology in its disciplinary relationship with Archivistics, Librarianship and Documentation, and the Museum as an information (and metadata) producing and managing entity, deepening theoretically convergence movements as LAM (Libraries, Archives and Museums).

Clearly, knowledge-driven societies need new tools but we believe that archives, libraries, and museums are likely sources for innovations in knowledge management. Likewise, these institutions can become important sites for teaching information literacy and developing skills in information retrieval and evaluation.

We also contend that archives, libraries, and museums will continue to fill a broad social need to decrease disparities between “information haves” and “information have-nots” especially as skills in acquiring, evaluating, manipulating, and generating information become more fundamental to individual and social well-being. [...] LAM must work at the center of epistemological frameworks that are simultaneously coherent and destabilizing, for there is no alternative mechanism for progress in knowledge (HEDSTROM e KING, s.d.).

The assumed positioning, applied to the U.Porto Digital Museum project, has the contribution of the epistemological and theoretical thinking (Silva & Ribeiro, 2002) and was framed by the intervention model MGSIU-AP, typified as systemic-informational and organizational/managerial model and pointing to a service-oriented approach (Pinto, 2015). This model was based on the research and diagnosis made at Portuguese Public Universities, specifically at University of Porto, and involving traditional services (Archives, Libraries, Documentation Centers and Museums), as well as the emerging ones such as Informatics and the Information Management function (Pinto, 2015).

Thus, the U. Porto Digital Museum project assumes a holistic, systemic and integrated approach, regarding information management and the impact of ICT. This reflection occurs on two levels: a) advantages and difficulties of standardization efforts on informational production, flow, organization and representation at the Museum; and b) addressing information sharing among information services within the university, leading to collaborative efforts directed at information management improvement in attaining a common institutional mission.

Given this conceptual model and the fact that the U.Porto Digital Museum must be able to integrate information from multiple disciplines and various sources, the authority control and descriptive metadata working group was formed in order to: a) build up a map of existing data elements in online

catalogues; b) analyse metadata requirements; c) adopt and implement descriptive metadata standards, such as CIDOC-CRM, which provides an extensible ontology for concepts and information in cultural heritage and museum documentation; d) and test the domain frameworks, developed with the direct involvement of a sample of U.Porto Museums and most significant collections. This sample differentially represented the disciplines, the collections and the user communities within the U. Porto from which the collections were drawn. It comprised the Museum of Natural History and Science of U.Porto, FEUPmuseum - Museum of the Faculty of Engineering of U.Porto, Abel Salazar House Museum and Museum of Medical History “Maximiano Lemos”- Faculty of Medicine U.Porto.

Initially we focused our attention on existing online catalogues in order to identify metadata structures, data elements and information representation and retrieval tools (classification schema, thesaurus, etc) that had been used to describe artefacts in the referred museums. Since 2008, every museum manages its collections using Index Rerum (<http://indexrerum.com>), presented as an integrated inventory, management and dissemination web based software, except FEUPmuseu which adopted In Arte (http://sistemasfuturo.pt/index_en.html), presented as a system in compliance with international standards of management and documentation of cultural heritage.

At this stage, we were also engaged in the process of mapping those elements, structures and tools whose heterogeneous nature soon became evident due to their varied provenance. Some of the key findings provide the background to the argument that, in order to build a future metadata structure(s) that can deal with this variety, it will be a top priority to fulfil two main goals: assure an answer to specific needs and clearly adopt international standards of management and documentation of cultural heritage, namely those developed by the Documentation Committee of the International Council of Museums (ICOM-CIDOC) and related areas, as Libraries and Archives.

However, additional metadata standards should be also considered, especially those that are capable to support the specificities of disciplines such as Natural History or Anatomy.

In order to provide an appropriate representation of U.Porto museums’ collections, the second stage was based on interviews in context with those museum curators for whom a data system that supports interoperability and access across collections (internal and external of the U.Porto management system) is a relevant need. Together with the curators, the team focused on evidence of the required types of descriptive metadata and controlled vocabularies.

The final phase comprises the cross evaluation of the collected data, regarding both metadata structures and values, terminology consistency and data transformations that should be accomplished before exporting data to a new system, in order to design an appropriate metadata infrastructure for such a multidisciplinary universe.

Additionally, the *U.Porto Museums Procedures Manual* is being developed with the direct collaboration of the U.Porto Museums, aiming at guaranteeing, through a set of clear instructions, the museological procedures/practices standardization and an adequacy to the specificity of each museum and collection. Based on SPECTRUM 4.0, a tool that implements and expands this work to the service management and procedures field, this manual consists of a group of procedures, activities and guidelines for U.Porto museums, describing how these tasks are to be carried out, in line with the museum diagnosis and good practices. This manual describes 21 collections management procedures in workflow format, along with the policies and minimum requirements. It contributes to the: preventing of errors, clarifying of the processes; coordinating activities; developing an orientation tool for the

service and its monitoring, including organization and representation procedures; fulfilling management's goals; and supporting the integration of new collaborators (Ferreira, 2016).

These activities were complemented by a *Software Requirements Document* directed at services and collections management, aiming to serve as a basis to a software evaluation, selection and acquisition. It was based on the previous standards and resulting frameworks and documents, as well as on the *Collections Management Software Criteria Checklist – 2012*, from the Canadian Information Heritage Network (CHIN). Two other guide documents were delivered: the *U.Porto Digitization Guide* and the *Digital Preservation Requirements Guidelines* (Rua, 2016).

RESULTS

ICOM guidelines suggest that museum documentation is concerned with the development and use of information about the objects within a museum collection and the procedures which support the management of the collection and will be recorded in a museum documentation system, underlining its importance:

“With effective documentation, a museum should be able to facilitate:

- collection policies;*
- collection care and accountability;*
- collection access, interpretation and use; collection research.*

[...]

4. The documentation system and the information it holds should conform to appropriate standards developed by national and international organisations, while taking account of local needs (Code 2.20). The documentation chapter in the ICOM guide to Running a Museum: a Practical Handbook has a comparison of a number of these standards, including the CIDOC Conceptual Reference Model (CRM), the CIDOC Guidelines, the AFRICOM Handbook and SPECTRUM. The LIDO standard should be taken into account when planning the contribution of data to, and interchange with, other systems (ICOM-CIDOC 2012).

Notwithstanding, the main challenge is not the implementation of a unique museum documentation system but, depending on the nature of the artefact and related information, it is how represent and describe it in the “right” form and with the suitable system, under the principle of interoperability and multilevel aggregation. As stated by Fernanda Ribeiro regarding archives field, we should discuss the interest and the use of classification in a transverse way (across collections and services), “either in what concerns intellectual organization of information, in a hierarchical structure of organic-functional or thematic type, or at information representation and retrieval level, regarding the informational content” (Ribeiro 2013). It is a question of improving knowledge and experience of archives and “how classification has been used in order to establish organizational schedules, which provide context to the informational production of the organisms (persons, families, corporate bodies) that generate the archives and how such schedules represent (or not) with scientific objectivity the informational reality being considered” (Ribeiro 2013) and the use of “indexing languages in other information systems, namely libraries, where subject classifications have a generalized application since the last decades of 19th century” (Ribeiro 2013).

Thus, the achieved results of the presented project are related with the empowerment of the university information system, its information services, specifically museums, framed by a trans and

interdisciplinary theoretical approach crossing Information Science and Museology with contributions of Information Systems in the context of a service-oriented approach.

As main result we point an operationalization toolkit which comprises:

- a theoretical framework and an intervention model (MGSIU-AP);
- an interdisciplinary authority control and descriptive metadata working group (curators, museologists, information managers - archivists, librarians -, computer specialists domain specialists);
- a transversal metadata set profile and domain metadata set profiles;
- the *U.Porto Museums Software Requirements Document*;
- the *U.Porto Museums Procedures Manual*
- and the *U.Porto Digitization Guide*.

Considered, but not yet concluded, are the *U.Porto Museums Metadata Guidelines*.

As an important work in progress, conducted by Sara Oliveira (2017), we point towards an experimental study directed at the heritage audiovisual content aggregation process, thus providing enriched and high quality data and metadata. It was based on the results of EUscreen and EUscreenXL and its main contribution, in an experimentation context, is the construction of an application profile - Dublin Core Application Profile (DCAP) - according to the rules defined by the Singapore Framework, a reference model for the description of resources that aims to implement semantics interoperability between different communities of practice (Malta & Baptista 2014). The created DCAP, named *Audiovisual Content Application Profile (ACAP)* contains functional requirements, a domain model, a description set profile, user guides and syntax guides (Oliveira 2017). This profile will improve both the information management within the audiovisual production of TVU., a U.Porto service targeting recordings, documentation and the communication of scientific knowledge and heritage, as well as its aggregation by EUscreen, a professional audiovisual content portal, and its consequent access through Europeana portal. The role of audiovisual content aggregators is essential not only to enable the availability of content on Europeana, but also to map and standardize metadata models from different sources into a common scheme, in this case Europeana Data Model (EDM) (Oliveira 2017).

Last, but not least, there is the development of a prototype - U.OpenLab - which provides support to the first experiences related with digital contents production based on museum's collections in the context of a *learning by projects* methodology applied to the real internal museum's needs / problems, encouraging professors, students and researchers to find solutions inside the teaching-learning process and through educational practices, namely assessment works (Pinto et al. 2016).

CONCLUSION

It is questioned, today, in which way the university museum expresses the faculties' mission and how they are part of the museum, especially when there is a diversity of materials, whose trace, was usually lost in the memory but obeys a logic of production and information recording. These artefacts arrived in the museum through donation, acquisition or transfer between institutions and involve personal, institutional and research paths. We know enough to understand that transferring networks of national and international scientific knowledge were built and should be promoted and preserved through rich and meaningful structures, descriptions and access points.

Only a systematic study allows the recognition of the processes of Science and Heritage production, reaching university individuals, artifacts and research paths, accumulators of an unrepeatably story and evidence of an institution activity. Only a systematic evaluation of a disaggregated collection (Zoology, Mineralogy, Botanic and Anthropology's materials, among others) can provide sense to a very rich universe. One must remember that one thing is the history of the institution and its communities and another is the way how they should be considered in a preservation, interpretation and information management policy, with the first usually being carried out within a legal and regulatory framework, whereas the second shelters a narrative that demands systematic information, resources crossing and a domain based description, technically accurate and which follows international standards and good practices.

These specificities of the university museums reveal a territory in which the borders between the education, the investigation and the museological practice blur. They are also associated to the concept of a digital space that establishes relationships between the museums, the libraries, the archives, the more recent "university information systems" and the different "communities" and collections. This digital space will allow the connection with the global networks, that go beyond the academy, building a meeting "locus" with individuals from "everywhere", independently of education level, acquired knowledge and singular interests.

To do so, it imposes, along with a technical and technological perspective, a more epistemological position, i.e., the information valuing as a human and social process and the historicity (organic-contextual production) of the cultural heritage and richness, instead of applying neutral rules of classification and inventory of the decontextualized collections that are numerous times only comprehended by the domain's specialists.

With the Digital Museum Project, the University of Porto proposes to:

- dynamically enrich the delivering of digital contents by the U.Porto Museums with the study, representation and description of the collections, as well as the efficiency of the information management processes and services (Pinto, 2015), with positive expression on the information seeking, retrieval and reuse;
- induce networking, collaboration and knowledge sharing among communities and disciplinary areas inside academia, as information management communities of practice, crossing functional, technical and scientific areas.

We believe that a "Digital Museum" will enable enhancing the shared creation, the open experimentation, the endeavours of volunteers around Heritage and the continuous update of the collections, the existences and the indicators of past existences, now gone, and from "today", according it is made the work to discovering, describing, representing, disseminating and developing them with the "unexpected digital media".

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REFERENCIAS

- Ferreira, F. (2016). *Uma plataforma comum para os museus da U.PORTO : gestão, processos e tecnologia*. (Dissertação de Mestrado), Universidade do Porto.
- Hedstrom, M., King, J. L. On the LAM : Library, Archive, and Museum Collections in the Creation and Maintenance of Knowledge Communities. Retrieved from <http://www.oecd.org/education/country-studies/32126054.pdf>
- ICOM CIDOC (2012). Statement of principles of museum documentation [Version 6.2, June 2012]. Retrieved from <http://network.icom.museum/cidoc/working-groups/documentation-standards/principles-of-museum-documentation/>
- Lourenço, M. C. (2006). Nota breve sobre os museus e colecções das universidades europeias. *Boletim da Rede Portuguesa de Museus*, 19 (mar 2006), 13-18.
- Lourenço, M. C. (2008). Where past, present and future knowledge meet : an overview of university museums and collections in Europe. *Museologia Scientifica Memoriae*, 2, 321-329. Retrieved from <http://www.anms.it/upload/rivistefiles/105.PDF>
- Malta, M. C., & Baptista, A. A. (2014). A panoramic view on metadata application profiles of the last decade *Int. J. Metadata, Semantics and Ontologies*, 9(1), 58-73.
- Medina, S., Pêgo, J. P., Machado, C., et al. (2009). Building a collaborative network for the digital representation of engineering collections. In *Putting University Collections to Work in Teaching and Research – Proceedings of the 9th Conference of the International Committee of ICOM for University Museums and Collections (UMAC)*. Berkeley, USA, 10 a 13 de September de 2009.
- Monteiro, M., Bernardo, L. M. & Araújo, J. M. (2008). Preserving memory in the University of Porto: the Physics Collection of the Faculty of Science. *Sci. Instrum. Soc. Bull.* 97 (June 2008), 27-30.
- Monteiro, Marisa L. & Soares, Miguel F.O. (2010). Meteorological (and other) instruments revealed: the Collection of the Geophysical Institute of Porto University. *Sci. Instrum. Soc. Bull.* 104 (Mars 2010), 17-21.
- Oliveira, T. C. M. (2010). *User generated content audiovisual para instituições de ensino superior: proposta de boas práticas*. (Dissertação de Mestrado), Universidade de Aveiro.
- Oliveira, S. (2017). *Disseminação de conteúdos audiovisuais na web : uso de um perfil de aplicação para a gestão e agregação dos recursos da TVU*. (Dissertação de Mestrado), Universidade do Porto.
- Pinto, M. M. (2015). The Portuguese University: Knowledge Leverage towards Innovation. In G. Jamil, S. Lopes, A. Malheiro da Silva, & F. Ribeiro (Eds.) *Handbook of Research on Effective Project*

Management through the Integration of Knowledge and Innovation (466-490). Hershey, PA. Retrieved from doi:10.4018/978-1-4666-7536-0.ch024

Pinto, M. M. (2015). *A Gestão da Informação nas Universidades Públicas Portuguesas : Reequacionamento e proposta de modelo* (Tese de Doutoramento em Informação e Comunicação em Plataformas Digitais), Universidade do Porto, Universidade de Aveiro.

Pinto, M. M., Matos, R., Medina, S., Abreu, R., Sousa, A., Faria, L., Amorim, J., Paiva, S., Martins, N., Barbosa, T., Figueiredo, T., Feio, P., Magalhães, D., & Almeida, M. (2016). Narrowing the gap between museums, classrooms and technology: the U.OpenLab Initiative Prototype . *ICERI2016 Proceedings*. (pp. 4442-4448). IATED Publications. Retrieved from doi: 10.21125/iceri.2016.2052

Ribeiro, F. (2003). *O Acesso à informação nos arquivos*. Lisboa : Fundação Calouste Gulbenkian; Fundação para a Ciência e a Tecnologia, Ministério da Ciência e do Ensino Superior. ISBN 972- 31-1017-2.

Ribeiro, F. (2007). “An integrated perspective for professional education in libraries, archives and museums: a new paradigm, a new training model,” *Journal of Education for Library and Information Science*, Spring, 48(2).

Ribeiro, F. (2013). O uso da classificação nos arquivos como instrumento de organização, representação e recuperação da informação. In *Informação e/ou Conhecimento: as duas faces de Jano – Atas do I Congresso ISKO Espanha e Portugal / XI Congreso ISKO España*. Faculdade de Letras da Universidade do Porto - CETAC.MEDIA. ISBN: 978-989-8648-10-5

Ribeiro, L. M., David, G., Azevedo, A., & Santos, J. C. M. (2001, March 28-30). Developing an Information System at the Engineering Faculty of Porto University. In J. Knop, P. Schirmbacher. *The Changing Universities. The Role of Technology: Proceedings*. Paper presented at International Conference of European University Information Systems, 7th, EUNIS, Berlin, Humboldt University. Retrieved from <http://hdl.handle.net/10216/606>

Rorschach, K. (2012). Why do universities have museums? Duke News. [Talk given at Nasher Museum of Art, 10.11.2004]. Duke University. Retrieved from http://www.nasher.duke.edu/about_from-director.php

Rua, J. (2016). *Digitalização, preservação digital e acesso em instituições de memória : contributos para o projeto Museu Digital da U.PORTO*. (Dissertação de Mestrado), Universidade do Porto.

Silva, A. M. da, & Ribeiro, F. (2002). *Das ciências documentais à ciência da informação : ensaio epistemológico para um novo modelo curricular*. Afrontamento.

Simões, M. G. (2011). *Classificações bibliográficas : percurso de uma teoria*. Coimbra : Almedina. ISBN 978-972-40-4608-2.

Stewart, Michael (2015). The University of Porto Science Museum. In Report of the Annual Study Conference: Portugal 3rd-8th May 2015, *Sci. Instrum. Soc. Bull.* 127 (December 2015), 21.