2022 REPORT ON

DIGITAL CURATOR MAPPING AND DESIGN

DC BOX
DIGITAL CURATOR TRAINING TOOL BOX

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About DCbox

DCbox "Digital Curator Training & Tool Box" works to create a new generation of European professionals working in the cultural heritage sector, equipped with a recognised, cross-cutting and high-level digital skillset. The project is funded by the Erasmus+ programme of the European Union during the period November 2021 - May 2024.

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Executive Summary

The present “Digital Curator Mapping & Design Report'' comprises the DCbox partners countries’ reports on two issues, the digital transformation of museum and the educational pathways to qualify as Digital Curator. The twofold analysis provides a sound base for identifying the main path that has to be developed as strategic for training the next generation of Digital Curators. This report focuses on the Mediterranean arena, however, in order to gather successful examples all over Europe, excellence stories have been collected and integrated in the final conclusion remarks.

The present report thus incorporates the Deliverable D1.1 - Report of the higher-education programs specificities in each country **(chapter 4)**, a synthesis of D 1.2 - Analysis and collection of DCH best practices and strategies **(chapter 3)** and the Deliverable 1.4 -Preliminary index of the DC roadmap **(chapter 7)**.

This report is intended to serve as white paper for identifying the professional profile of a Digital Curator and to lay the foundations for a theoretical and practice-based framework of creating a training profile for a Digital Curator. As the main goal of DCbox is to create a new generation of European professionals working in the cultural heritage sector, equipped with a recognised, cross-cutting and high-level digital skillset – both issues have to be analysed, how museums are making use digital advancements, and on the flip side, what offers exist for professional training. This enables DCbox to better identify skills and competences needed, from an educational and professional perspective. It is imperative to take the detected lack of clarity on the professional profile, as well as the lack of a comprehensive educational offer which includes the potential skills needed to train the future Digital Curators. DCbox understands Digital Curator as an emerging professional profile able to tackle and manage all challenges that have been exacerbated by the COVID-19 pandemic and the consequent need to rely on digital, smart and connected museums.

The first results of the analysis show that to date there is no single, unanimously agreed reference framework to empower learners with skills, competences and expertise a Digital Curator should master. Six multidisciplinary areas, Humanities, Museology, Digitization and VR, Management, Design and Communication that permeated by the digital, emerged from analysis as strategic for training of a Digital Curator. The blending of these multidisciplinary areas enables to reach a unique mix of functional expertise, both theoretical and practical, needed to equip museums and cultural bodies for future challenges.

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1. Rationale of this report and methodology

Introduction

The “Digital Curator Mapping & Design Report'' aims at defining the main guidelines needed for defining the Digital Curator professional profile. The Digital Curator (DC) is an emerging professional figure whose relevance has been emphasised with the rampant COVID-19 pandemic and the consequent need to rely on digital, smart and connected cultural offers, including museums. Nevertheless, up to date there is no single, unanimously agreed reference framework to empower learners with skills, competences and expertise a DC should provide, imparting technical knowhow and humanistic background.

In order to address the lack of clarity on the potential skills of a DC, how to master them and to define a professional training programme, an in-depth analysis of the different scenarios has been realised exploiting the DCbox consortium network and competencies. The twofold analysis regarded both an overview of the digital transformation of museums and the educational pathways to qualify as Digital Curator. This report focuses on the Mediterranean arena. However, in order to gather successful examples all over Europe, excellence stories have been collected and integrated in the final conclusion remarks.

This report is intended to serve as white paper both for students, who intend to embark in courses of study, and subsequently in careers, linked to the digital transformation of museums, professionals actively involved in digitization projects, and museums themselves, wishing to upgrade and re-think the visitors' experience according to new digital advancements and possibilities.

About the DCbox project

The main goal of DCbox is to create a new generation of European professionals working in the cultural heritage (CH) sector, equipped with a recognised, cross-cutting and high-level digital skillset. More specifically, the project is aimed at: a) better defining the professional figure of ‘digital curator’, owning digital, marketing and communication skills to engage a broader and more variegated audience; b) taking advantage by positive effects of digital transformation in CH and tackling negative effects on museums and archaeological sites brought by COVID-19 through the development of high- quality digital contents and virtual visits; c) creating a cross-European network of universities, museums and IT enterprises, acting as a workspace for mutual learning, sharing of experiences and active experimentation in the process of cultural heritage digitisation.

Methodology

In order to achieve a comprehensive understanding of the DC profile, a state-of-the-art review was completed highlighting the figure of the “curator” over time and the impacts of the digital revolution on the “curator” with a focus on policy documents from the year 2000 onward. Special attention was dedicated to the opportunities and challenges of working in the field of digital humanities, reviewing recent EU projects, new perspectives and trends.

Two main domains have been then initially selected to start framing the background of the Digital Curator professional profile: how museums transformed and embraced digital technologies, and which are the opportunity for students to gain skills and shape a new museum curator profile.

This report was realised with the collaboration and contributions of all the DCbox partners who analysed their own national scenario and use-cases of their neighbouring countries.

Each partner individually performed a desk-based assessment using a shared template in order to achieve an overall structural and methodological consistency. Data have been hence analysed from a quantitative and qualitative point of view to support the final conclusions and recommendations.

Quality Assurance and Quality Control mechanism

Quality Assurance and Quality Control (QA\QC) is the process used in the management, coordination, control, delivery, or support of an item required for quality assurance purposes. QA\QC document control is an essential part of the quality assurance system.

For this report a redundant mechanism has been set up based on:

- a shared document,
- a Track-Changes,
- a peer-review system.

A shared document has been created exploiting the https://univpm.sharepoint.com. The Cyprus Institute was in charge for the overall monitoring and the implementation of chapters 1, 3, 6 and 7.

UNIMED was leading the harmonization of the different contributions received by the DCbox partners.

The report was edited in Track-Change mode. This allowed to standardize the process to Initiate and Document Change Request, Review and Approve Change Request, Notify the Change to Impacted Users.

Nevertheless, all partners were granted access to the content development for a final peer review until the last version of the document was approved by the project leader and licensed.

2. The Digital Curator professional profile and definitions

In order to provide a sound base to define a DC and to outline his/her role and profile, it is necessary to introduce a brief historical excursus on the figure, then it is presented a state of the art on what are educational qualifications and competencies required for a DC. The present literature review is mainly based on EU policies, addressing documents and recommendations by international institutions recognized within the museums domain.

The figure of the "curator" over time

Since the Middle-Age the figure of "curator" was defined as the responsible for private collections of artworks called Wunderkammer. The need was to engage a person with a proper knowledge and taste, able to classify the objects, but without the aim of a public exhibition. In fact, the latter concept came out after the birth of the modern museum in 1793 thanks to the establishment of Musée du Louvre in Paris. Till the first half of the 19th century the role of the curator was strictly referred to cataloguing, classification and preservation of artworks. Things started to change when in 1855 the painter Gustave Courbet realised his own exhibition after a refusal from the Salon's jury.

This artist/curator figure succeeded, especially since the early 19th century when it became quite usual for artists to setting up their own artworks in an off-museum context. The exhibition was a true work of art and was a public outcry addressed to museums, considered antiquate institutions that didn't enhance their collections [1].

In 1923, the Landesmuseum's director Alexander Dorner defined a new, modern concept of museum. It must be a dynamic organism that embraces the contemporary and involves the visitors. He started, among others, to collaborate with artists, architects and designers in order to make museums a reference of the contemporary context [2].

The figure of curator became, gradually, even more significant and independent for the entire 20th century till the 1990's when it reached its peak [3]. In this decade, studies have been done about the background and the development of this figure. A remarkable act was the effort to provide proper tools to people that were approaching this profession. This became possible through several training courses provided by public institutions and universities [4].

From this point on, the curator could be considered as the intermediary between the artwork and the public of a museum/cultural heritage exhibition.

The impacts of the digital revolution on the "curator": policy documents since 2000

Due to the digital revolution new requirements and new challenges came out. Initially the use of Information and Communication Technologies was regarded as a narrow technical field, the creation, promotion and preservation of digital information came to the fore in the mid-1990s [5]. Moreover, another study highlighted the lack of recognized and validated digital competences to be included in digital curation education programmes [6].

Since the very beginning of the 2000s, a series of policies addressing documents and recommendations have been provided in order to face this scenario. The most relevant measures,

taken by the European Commission and other public institutions, have been selected and analysed in order to give a proper status report.

In 2004, ICOM (International Council of Museums) provided the *Curricula Guidelines for museum professional development* [7] and defined several competencies gathered in five macro-groups:

I. General competencies: All museum staff should be able to demonstrate skills in and knowledge of:

- Communications - Environmentalism and its impact - Evaluation methods - Financial management - Information Technology - Interpersonal relationships - Museums and society - Nature of work – Professionalism - Project Management – Research - Resources in the field.

II. Museology Competencies: Knowledge of and skills in the application of the intellectual foundations of museum work.

- Community museology - Development of the museum profession - Roles and functions of museums – Vision – Governance - Issues in museum practices - Legal context for practice - Research activities, both discipline-based and museological;

III. Management Competencies: Knowledge of and skills in the theory and practice of museum operations.

- Accreditation - Advisory bodies – Architecture - Business and operational management - Community relations - Financial planning and management - Formal structure - Fund raising and grant development (income generation) - Human resource planning and management - Information management - Insurance / indemnity – Law – Marketing - Membership / "friends" organisations - Physical plant and site management - Public affairs - Media relations - Organisational Theory.

IV. Public programming competencies: Knowledge of and skills in serving the museum's communities.

- Communications – Exhibitions - Education and interpretation - Publications and products - Visitor service and public relationships.

V. Information and collections management and care competencies: Knowledge of and skills in creating, preserving and sharing museum resources.

- Archives - Collections.

This last group of competences can be easily seen as connected to the curatorial competences, while in general no specific mention to digital literacy is made on the whole list.

In 2006, the European Commission provided the *Recommendation on the digitisation and online accessibility of cultural material and digital preservation* [8], which seeks to optimise the benefits of the new information technologies for economic growth, job creation and the quality of life of European citizens. The Commission defined digitisation as the only means of ensuring that cultural material will be available for future generations. Furthermore, it encourages the development of

digital libraries for digital preservation of Europe's collective memory and investments in new technologies in order to bring down costs of digitisation.

In 2008, the ICOM International Committee for the Training of Personnel (ICTOP) drafted the *Museum Professions – A European Frame of Reference* [9]. The objectives were to renew the previous 2005 document and to outline new profiles of museum workers, according to its mission to promote training and professional development and to establish standards for museum personnel throughout their careers. ICTOP also acts as an advisor for the establishment of syllabi for personnel training and works closely with other ICOM Committees to achieve its goals.

The 2008's document defines, among others, some requirements that curators should meet such as a university degree and competences in museology (both theoretical and practical.) Again, there are no specific references to digital skilled professionals. The recent projects published by ICTOP seem oriented to heritage conservation, as demonstrated by the 2022 young professionals' forum, in which emerging skills for preservation, participatory conservation and public engagement for conservation are mainly investigated [10].

A remarkable step in the EU panorama of open digital collections was the establishment of the web portal Europeana [11], launched in 2008. It provides a number of digital contents (audio, images, video, and recently 3D models) of European cultural heritage. Currently there are about 58 million digitised documents from more than 3600 public institutions. According to the Europeana Pro page website: as COVID-19 changes and challenges the cultural heritage sector, the importance of building capacity for digital transformation is clearer than ever. Europeana has developed a phased project to help identify and shape a capacity building framework based on the needs of the Digital Cultural Heritage sector [12]. It is relevant, here, just to summarise the 4 steps foreseen: **1) sensemaking digital transformation, 2) defining digital transformation, 3) training courses inventorisation, and 4) developing a capacity building framework.**

In 2011, the European Commission (EC) published the *Recommendation on the digitisation and online accessibility of cultural material and digital preservation* [13]. The need was to face the lack of consistent progress across the Member States and the unevenness of different points of the 2006 Recommendation. Therefore, an updated set of measures for digitising and bringing cultural heritage online and for digital preservation was recommended to the Member States. In addition, EC encouraged the development of digitised material from libraries, archives and museums in order to ensure that Europe maintains its place as a leading international player in the field of culture.

In 2012, CEN (European Committee for Standardisation) drafted a CWA (CEN Workshop Agreement) which defines a set of European ICT Professional Profiles using the European e-Competence Framework (e-CF) [14] as the basis for competence identification. Specifically, 23 generic professional profiles were identified to give greater homogeneity to the various professional figures related to ICT present in the various European countries. These profiles have been structured into 6 large and generic families which represent the "first generation":

- Business Management;
- Technical Management;

- Design;
- Development;
- Service & Operation;
- Support.

From these, the 23 professional figures are latter defined, representing the “second generation”. The aim of this document was to draft a clear taxonomy of the complex European framework regarding ICT professions in order to create a model, exploitable by European stakeholders, for developing new profiles in the future.

In 2017, the European Commission’s expert group on Digital Cultural Heritage (DCH) and Europeana [15] was established. The group has many missions such as the review and discussion of policies for digital cultural heritage, monitoring and assessing the progress and the impact of the implementation of the European Commission 2011 Recommendation, to contribute to the evolution and sustainability of Europeana and to support the Commission in defining the general objectives and priorities for actions.

In 2021, the European Commission presented a vision and avenues for Europe’s digital transformation by 2030. The Commission proposes a Digital Compass for the EU's digital decade [16] that revolves around four cardinal points: skills, government, infrastructures, business, aiming at the digitalisation of public services, the digital transformation of business and the making of a secure and sustainable digital infrastructure.

The Commission will pursue the EU’s digital ambitions for 2030 through concrete terms: targets and projected trajectories; a robust joint governance framework to monitor progress and address insufficiencies; multi-country projects combining investments from the EU, Member States and the private sector. Although this document is not specifically depicted in reference to the CH sector, it is undoubtedly part of the disruption caused by the pandemics.

If the richness of the above-mentioned initiatives makes clear the centrality of DCH sectors, the current state of policies increasingly denounces the need of new programmatic actions to start thought shared roadmaps but to be implemented mainly on a local scale. This was also highlighted by the public consultation held between June and September 2020 [17]. Beside other replies, it is worth mentioning that respondents were asked about the importance of supporting digital transformation in the cultural heritage sector in the aftermath of the COVID-19 crisis. 81% strongly agreed that the EU and Member States should intensify their actions updating skills and facing the mismatching between digital competences and humanities careers learning pathway. In addition, applications of 3D technologies in the area of cultural heritage were considered very valuable. For example, 92% considered 3D valuable or very valuable for creating digital twins of cultural heritage buildings, monuments and sites, 91% for museum objects and 88% for immersive experiences. In general, it was recognized that the potential of 3D digitization is under-exploited. Just to give a picture of available digital skills inside the museums staff, we refer to the 2020 Nemo Final Survey on COVID-19 situation on EU museums [18], 4 out of 5 museums have increased their digital services to reach their audiences, often by having staff accept new tasks to cope with the circumstances. The

museums were able to react, but without dedicated staff. In the follow-up of the Report [19], dated January 2021, it is stated that concerning skills necessary to accommodate operations in the pandemic, almost 50% of the respondents claim that they lack of skills in digital literacy.

With the 2021 *Recommendation on a common European data space for cultural heritage* [20], the European Commission declares the importance of facing the financial loss due to the COVID-19 pandemic. Moreover, in order to pursue the EU's 2030 objectives, the EC encourages Member States to put in place appropriate frameworks to enhance the recovery and transformation of the cultural heritage sector. This advanced digitisation of cultural heritage assets and the reuse of such content can generate new jobs. Proper initiative, such as the Coordination and Support Action for the establishment of a European museum collaboration and innovation space in the framework of Horizon EU, testifies both the effort in museum digital transformation support both the idea to completely upgrading the way in which for museums work with creative and technology partners, as well as with each other. In fact, the call, throughout experimental activities applying digital technologies in an innovative way, leads to a collaborative project structure for museums and cultural organisations in Europe, where the outcomes and the detailed documentation of the implemented individual projects will be shared through a cloud-based collaboration and innovation space, to serve as examples of reference, best practice and source of know-how for the museum sector. The outcomes expected by the call highlight clearly that the digital transformation of museums is considered as a layered and challenging task and its obstacles are overcome by a cross and interdisciplinary EU infrastructure.

Working in the field of digital humanities

As it emerges from the above analysis, the panorama of DCH is very proactive and proficient, but featured by the persistency of the well-known gap between Social Science and Humanities background and a training path that includes digital preparedness. Also, the larger Digital Humanities (DH) field is shaped by a multi-level scenario, in which the European Commission (2006) conceived some solutions such as the DH labs and research infrastructures: the founded initiatives and research networks have been playing a significant role at national and international level. It is worth mentioning the definition of what is and is not a research infrastructure: "… facilities, resources or services of a unique nature that have been identified by pan-European research communities to conduct top-level activities in all fields. The Commission also ensures that these research infrastructures are open and accessible to all researchers in Europe and beyond." Their establishment and support are key answers to promote the collaboration among different skills, practitioners, professionals and institutions.

The PARTHENOS project (2015-2019) [21] aimed at strengthening the cohesion of research in the broad sector of Linguistic Studies, Humanities, Cultural Heritage, History, Archaeology and related fields through a thematic cluster of European Research Infrastructures, integrating initiatives, e-infrastructures and other world-class infrastructures. It has devised a series of training modules and resources for researchers, educators, managers, and policy makers seeking to learn more about research infrastructures and the issues and methods around them. Virtual Research Environment (VRE) has resulted from the PARTHENOS project [22]. It is a web-based collaborative working

environment providing its users with a rich array of ready-to-use humanities assets (datasets, tools, and services) suitable for supporting all the phases of a research lifecycle.

Other institutions and studies provided further definitions about the role of a Digital Curator and what kind of knowledge and skills he/she is supposed to possess.

The Digital Curation Centre (DCC) was established in 2005 to help solve the extensive challenges of digital preservation and digital curation and to lead research, development, advice, and support services for higher education institutions in the United Kingdom. According to DCC, digital curation is the management and preservation of digital data/information over the long-term [23].

In Madrid [24] the author (2011), after several professionals' evaluations, gave this definition:

"Digital curators have a range of managerial and operating skills including: domain or subject expertise; good IT skills; and knowledge of best practices in acquiring, organising and managing digital objects and digital collections for long-term access, preservation, sharing, integrity, authenticity and reuse."

In [25] Robinson (2009) described the knowledge and skills needed by the repository managers and administrators and grouped it into nine categories: management, software, metadata, storage and preservation, content, advocacy, training and support, liaison (internal) and liaison (external), and current awareness and professional development.

Towards a new professional profile: recent EU projects and new perspectives

As an effective step towards identifying the digital curator's profile, many European projects have been founded in programmes dedicated to the upgrading of skills or to lifelong acquisition of innovative and transversal competences. Here we propose a selection of the projects clearly related to the aims and objectives of DCbox.

The DigCurV project (2011) [26], funded through the European Commission's Leonardo da Vinci Lifelong Learning Programme, has constructed a framework to support the development of curricula for the vocational training of digital curators working in cultural heritage.
It developed three distinct lenses or views on the framework to enhance usability. Each of these lenses corresponds to a different group of staff in curation activities:

- Practitioner. The lens focuses on the skills, knowledge and competences required for the planning and execution of specific digital curation tasks.
- Manager. Lens focuses on a higher-level understanding of the procedures and components of curation programmes.
- Executive. It focuses on high level strategy and places emphasis on digital curation in the context of the parent organisation's business model and mandate.

The E-cult skills project (2013) [27] investigated the knowledge, digital skills and competences needed for professionals in the museum sector to become proficient in the use of digital technologies in the field of culture adopting the European Framework for e-Competence (e-CF).

The project outlined five job role-profiles as a response to help museums through their digital journey:

- Cultural ICT Consultant;
- Cultural ICT Guide;
- Digital Cultural Asset Manager;
- Interactive Cultural Experience Developer;
- Online Cultural Community Manager.

The Mu.SA "Museum Skills Alliance" project (2019) [28] aimed to address the increasing disconnection between formal education and training and the world of work. It aims, as well, to better manage the emerging of new job roles due to the increasing use of ICT (Information and Communication Technology) in the museum sector. The activities focus on the preparation of the MOOCs (Massive Open Online Courses) on essential digital skills for museum professionals: they include e-learning and face-to-face lectures in order to acquire digital and transferable competences.
Furthermore, Mu.SA investigated whether the previously identified five role profiles for the museum sector within E-Cult Skills project were still relevant and applicable. Thus, in light of the research findings, the most relevant emerging role-profiles have been updated and renamed:

- Digital Strategy Manager;
- Digital Collections Curator;
- Online Community Manager;
- Digital Interactive Experience Developer.

The Digital Collections Curator is responsible for implementing the digital strategy relevant to collecting, storing, archiving, preserving and making accessible the digital collections (either born – digital or digitized). In larger museums this could be a role-profile, while in smaller museums a curator should be up skilled in the area [29].

The Erasmus+ funded project CHARTER (Cultural Heritage Actions to Refine Training, Education and Roles) [30] started in January 2021, and seeks to create a lasting, comprehensive sectoral skills strategy to guarantee that Europe has the necessary cultural heritage skills to support sustainable societies and economies, including transversal competences such as digital/technological and green/blue economy skills. The consortium of 47 partners represents some of the top education and training institutions, organisations, networks and employers of the European cultural heritage sector.
The main objectives are:

- Clarify occupational roles and activities as well as create tools for an integrated, responsive education system.
- Identify curricula and learning outcomes to equip education and training to respond to current and future needs for cultural heritage skills.
- Structure cultural heritage as an economically active sector.

In conclusion, although it still seems urgent the necessity of capacity building by merging humanistic and technological perspectives in order to take care not only of tools and computational resources but also of the human capital, the panorama shows some good achievements and action lines.
A Digital Curator must be a multifaceted profession able to design, perform and promote a digital strategy, for documentation, conservation, enhancement and presentation of cultural contents. Therefore, he/she must lead the whole digitisation and digitalisation process, based on ICT, managerial and Humanities skills and competences combination.

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3. An overview of digital transformation of museum (D1.2)

A mapping exercise of digital practices in museums and heritage sites across Europe was done in order to gather and analyse information on best practises relating to digital cultural heritage tools and digital strategies. Each partner gathered research and information on their own countries plus additional neighbouring countries. The splitting of the country groups is listed below:

Cyprus + Greece (CY + GR)
Eastern Europe (RS, BG, RO, MK, BA, ME, HR, CZ, RU)
Italy + Croatia (IT + HR)
Spain + France (ES + FR)
Portugal + Germany (PT + DE)
Great Britain (GB)
Denmark (DK)
Qatar (QA)
Other (Web resources)

Museums, archaeological sites and many other cultural heritage sites were researched to ascertain what kind of digital tools or technology have been put in place to provide user-friendly, attractive, innovative and interactive tools for visitors. The results have been summarised in the Table 1, and show a breakdown of the most used digital tools.

Technology	No. Examples
Web	47
Virtual Tour	46
Non-Immersive	19
AR Vision Based	16
3D Printing/models/animations/mapping	13
Cataloguing	12
User Guidance	11
Fully-Immersive VR (CAVE)	11
Fully-Immersive VR (Head Mounted Display)	9
AR Sensor-Based	7
Mixed Reality (see-through glasses)	4
User tracking behaviour	4
Photogrammetry	2
Semi-Immersive VR	1
4D Models	1

Table 1. Shows the results from the mapping exercise

As we can see from Table 1 and Figure 1, the most reoccurring digital tool used was the 'Web'. This included advances such as website creations and making museums more accessible online for people to visit from their homes or anywhere remotely. In some cases, such as in Italy, entire online museums were created with the aim of reaching larger audiences. Mobile applications also fell in the category of 'Web' with many countries creating applications either for archaeological sites or monuments. In Cyprus for example, a QR code was installed in front of some important statues in Larnaka town. Visitors simply scanned the QR codes through their mobile phone camera and an audio was played describing the story of the statues and their importance. This is a great way to create interactive and immersive experiences for visitors in major cities across Europe.

A very close second to 'Web' tools, was the 'Virtual Tour' tool. Almost every country reported at least one example of virtual tour in museums or archaeological sites. Many were created in response to the pandemic to give people the opportunity to still 'visit' the museums and look through the exhibits. The 'Virtual Tour' tool also allowed smaller museums and archaeological sites to be highlighted and draw in larger crowds. Creating new technologies to compliment museums and their exhibits were also used to attract younger visitors and create educational programmes for children. This is evident from examples given by Spain, Portugal and many Eastern European countries such as Serbia, Bulgaria and Romania.

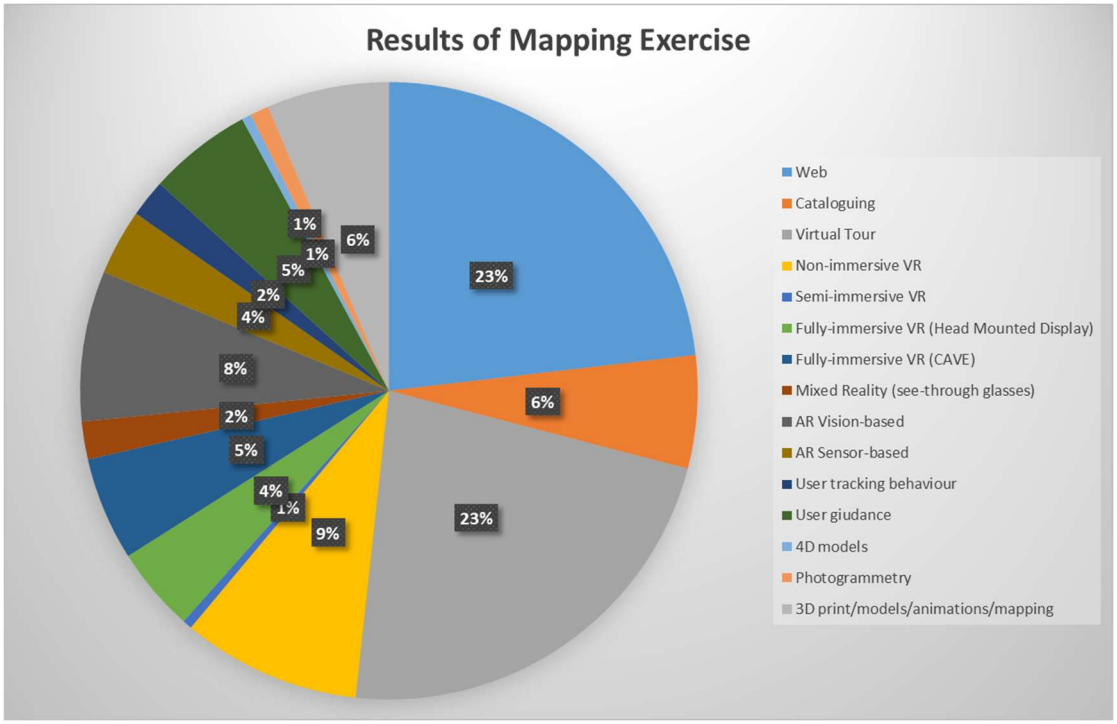

Figure 1. Shows the results of the mapping exercise through a statistical analysis.

Table 2 depicts the same results by countries. It goes however into a more detailed breakdown of each individual group and their results. This is a clearer way to see exactly which countries are using which digital tools and technology. In this table we can see that Portugal and Germany use 'web'

tools more than any other country in our sample. Other innovative technologies such as Non-Immersive VR and AR Vision-Based are strongly represented in some countries, such as Italy.

Virtual tours and websites, on the other hand are more straight forward, and do not require sophisticated equipment in their creation, which could be a reason to be so commonly used across the countries.

Both technologies still need trained professionals but taking into consideration some of the other typologies we have [I.e., fully-immersive VR (CAVE)], which are much more complex and expensive, it is understandable why these two tools are most frequently used. 4D models which are considered to be on the expensive side, although a valuable tool, is mentioned only once among our large sample. Museums may lack the financial resources for such expensive and specialised equipment at this point in time. These more complex technologies may also require specialised personnel to able to deal with maintaining the technology, something that may not be so sustainable or cost effective for some areas. In general, we can observe that as the cost of the technology rises, the frequency in which it is used falls.

A note that was made during this exercise, which can be helpful moving forward, is that technology also needs to be sustainable and be able to change with new emerging advancements. In Cyprus for example, virtual tours were created for a number of UNESCO World Heritage Sites which used Flash Player. However, since 2020 Flash Player is no longer supported therefore making these virtual tours unavailable to the public.

Technology	Country Groups								
	CY+GR	Est.EU	IT+CR	ES+FR	PT+DE	GB	DK	QA	Other
Web	6	2	12	10	13	2	0	0	2
Cataloguing	4	0	4	1	1	1	0	0	1
Virtual Tour	10	4	7	13	11	0	0	0	1
Non-Immersive VR	6	1	8	1	0	1	0	1	0
Semi-Immersive VR	0	0	1	0	0	0	0	0	0
Fully-Immersive VR (Head Mount.Display)	0	1	5	3	0	0	0	0	0
Fully-Immersive VR (CAVE)	1	1	6	2	0	0	0	1	0
Mixed Reality (see-through glasses)	0	0	1	3	0	0	0	0	0
AR-Vision Based	1	2	9	3	0	0	1	0	0
AR-Sensor Based	1	1	0	5	0	0	0	0	0
User Tracking Behaviour	1	1	1	0	0	0	1	0	0
User guidance	6	1	2	0	2	0	0	0	0
4D Models	0	0	0	0	1	0	0	0	0
Photogrammetry	0	1	1	0	0	0	0	0	0
3D Print/Models/animations/mapping	0	3	2	5	1	2	0	0	0

Table 2. Shows the technology used by country groups

This is a summary of the findings from the mapping exercise. Findings could be presented as a matrix (+ link to the interactive map)

4. Educational pathways to qualify as Digital Curator (D1.1)

To reflect the challenges and skills for professional training of a Digital Curator, DCbox collected an overview on the national landscape related to the digital transformation in museums in Cyprus, Greece, Italy, Portugal, Serbia and Spain. The DCbox partners provided a report on the national educational programmes and where appropriate provided insights on opportunities that universities offer or challenges that an educational programme might face.

This section contains a description of current legislation or practices for a museum's Digital Curator. When possible, the partners selected and described examples of higher education programmes and/or single courses which are relevant to support the development of competencies for a Digital Curator profile. The criteria for selecting of examples should be sufficient broad to encompass innovative programmes; "Digital Curator" should be specifically mentioned among the occupational profiles target by the programme and the following keywords or skills: data curation, virtual contents design, storytelling, social media strategies, management of digitization processes.

Educational pathways in Cyprus and Greece

Contributors of the analysis: Antonia Agapiou, Dante Abate – The Cyprus Institute

Date: May 10th, 2022

Data sources used for the analysis: Course documentation, websites

References:

[1] Convention Concerning the Protection of the World Cultural and Natural Heritage https://whc.unesco.org/archive/convention-en.pdf

[2] Department of Antiquities http://www.mcw.gov.cy/mcw/da/da.nsf/DMLdirector_en/DMLdirector_en?OpenDocument

[3] The Antiquities Law – Cyprus http://www.mcw.gov.cy/mcw/da/da.nsf/All/A2ABFCFE258EFD71C22571A2003A2B9D/$file/law-en-1.pdf

[4] [N.58 (I)/2009] - The Law on Recognition of Private Museums and Museum of Local Authorities (Procedure and Conditions) Act of 2009 (in Greek) http://www.mcw.gov.cy/mcw/da/da.nsf/All/DC0E40768F1A2D67C22576B000450DEF/$file/private%20museums%20law.pdf

[5] Digital Strategy for Cyprus – February 2012 https://dec.dmrid.gov.cy/dmrid/dec/ws_dec.nsf/68E7913001B3FC41C2258570003FE06E/$file/04Digital%20Strategy%20for%20Cyprus_Executive%20summary.pdf

[6] ICOMOS Cyprus Page

https://www.facebook.com/pages/category/Interest/ICOMOS-Cyprus-515418001832874/

[7] 'Cyprus Archaeological Digitization Project' (CADiP) http://www.mcw.gov.cy/mcw/da/da.nsf/all/1A7BF21DA2D1652DC225750C00228456?opendocument

[8] 'Digitising the Museums of Cyprus' http://www.mcw.gov.cy/mcw/DA/DA.nsf/All/CC01D912E8B50035C22586EA003C2500?OpenDocument

Introduction

This section describes six case studies identified due to their relevance to the DCbox project domain, located in Cyprus and Greece. For the latter, 2 examples are reported.

In detail the educational offer described below, refers to:

- Master in Digital Cultural Heritage (The Cyprus Institute, Cyprus);
- Single Course in Curatorial Practices (Frederick University, Cyprus);
- Master in Digital Art and Design (University of Cyprus, Cyprus);
- Master in Digital Heritage and Landscape Archaeology (University of Cyprus, Cyprus);
- Master in Digital Methods for Humanities (Athens University of Economics and Business, Greece);
- Bachelor in Archives, Library and Museology (Ionian University, Greece).

The criteria used in selecting the following programmes are focused on their strong foundation on digital methods within the wider humanities and heritage areas. The programmes/courses described below provide essential skills and tools that a Digital Curator would need in their future career. During the desk-based research it can be highlighted that museums and other heritage sites establish a digital presence, which has been more noticeable over the last couple of years largely due to the pandemic but also to create more immersive and modern museums.

Regulation of the digital curator professional

There is no specific law or legislation to regulate the role of Digital Curator. Article 4 and 5 of the Convention for the Protection of the World Cultural and Natural Heritage, Paris, 16 November 1972 [1] states that the protection of cultural heritage falls upon each state/country to ensure effective and active measures and policies. Being from 1972, this does not mention digital museums or digital curation, but it does emphasise the importance of protecting cultural and natural heritage for future generations.

The responsibility of public museums in Cyprus falls under the Department of Antiquities [2] and more specifically the role of Curator of Antiquities. The Curator of Antiquities oversees the process of renovating museums, creating new ones, digitising collections, sites and monuments through several EU or other co-funded projects. All activities in Cyprus connected with heritage protection are linked with national legislations such as the Antiquities Law [3] which sets strict rules aimed towards the protection of the country's cultural heritage; Law N.58(I)/2009 [4], which refers to

private museums, states that such museums will fall under a Museum Committee which will consist of five members, two of them being individuals with a specialty or work experience in museum related occupations such as Museology or Curation.

As far as digital curation in museums goes, many public and private museums have advanced their digital presence through projects with consultants such as marketing companies or other technological institutions. The Ministry of Communications and Works through the Department of Electronic Communications, also issued in 2012 a 'Digital Strategy for Cyprus' [5] which included measures and actions specifically for digitisations of museums. The actions included digitising exhibitions and development of a 3D digital museum. Even though the government is investing in digitisation projects, these do not specifically mention the role of Digital Curator when referring to museums.

The ICOMOS Commission Cyprus Division, was established in 2003 in accordance with the statute of the international council and has in the last couple of years promoted digital cultural heritage and digitisation, through webinars, conferences and presentations such as the 'Digital Cultural Heritage: Technologies and Challenges' [6] in 2020 where they discussed the role of new innovated technologies in the heritage sector and prospects for the future.

Since 2009 and more recently since the beginning of 2022, large projects have been underway, through the Department of Antiquities, called the 'Cyprus Archaeological Digitization Project' (CADiP) [7] and 'Digitising the Museums of Cyprus' [8], which aim to create a fully digitised database to increase efficiency and effectiveness in retrieving Cypriot archaeological data. Digitisation is regarded as one of the main objectives and priorities for the Department of Antiquities, in relation to the protection of cultural heritage.

These strategies and organisations leading research projects focusing on digitisation provide an important step forward, showing an increased interest in digital cultural heritage.

Examples of programmes

Title of the programme	Digital Cultural Heritage
University, Country	*The Cyprus Institute, Cyprus*
Relevant URLs	*https://www.cyi.ac.cy/index.php/education/masters-programs/digital-cultural-heritage/masters-dch-program-overview.html*
Level	*Second Cycle (Master)*
Type of Institution	*Private*
Delivery mode	*Face to face*
Qualification awarded	*MSc Digital Cultural Heritage, EQF 7 can also be continued into a PhD programme, EQF 8*

Key aspects **Description of the programme/ curriculum**	*Aims to provide new scientific knowledge that will enrich and enhance the research and academic careers of its participant students. The programme's goal is to prepare students for careers as scientists and experts in Cultural Heritage with a strong background in the use of digital tools and scientific methods. The Digital Cultural Heritage MSc course offers a unique interdisciplinary approach to critical challenges in Cultural Heritage research, conservation, management and public engagement through the effective use of digital methods and applications. Furthermore, the programme places great emphasis on the methods and approaches applied to real problems in the field, in collaboration with key cultural heritage bodies on the island. A key priority of the programme is to expose students to the wide spectrum of digital applications in a range of fields from the humanities as well as from the sciences.* - *specific content/themes: Digital Curatorship - purpose of the course is to familiarize students with the transformations of the museums' role in contemporary societies due to the integration of technological interfaces when interacting with knowledge. Its objectives include the understanding of the new relationship of museums with their audiences, reflecting on new educational models and opportunities offered by technology, and critical use of ICT for the creation of new curation models for the museum of the future.* - *Lectures and practical work* - *Introduce concepts of Cultural Heritage research based on digital tools and methods, along the research pipeline of data acquisition – archiving – processing – interpretation – publication, through a variety of examples covering the broad spectrum of Cultural Heritage*
Learning Outcomes	*The programme's goal is to prepare students for careers as scientists and experts in Cultural Heritage with a strong background in the use of digital tools and scientific methods. Students will gain knowledge on key components and structure of research, how to choose the most suitable technologies and methods to be employed for achieving the research goals and how to perform such research in a multi-disciplinary environment.*
Occupational profiles of graduates (with examples)	*Graduates of the programme will be competitive to pursue work in the private or public sectors of Archaeology, Cultural Heritage Management, History and Art Architecture, Museum Studies or the Study, Rehabilitation and Management of the Historical Structured Environment.*

Title of the programme	Curatorial Practices
University, Country	*Frederick University, Cyprus*
Relevant URLs	*https://www.frederick.ac.cy/ma-in-fine-art-program-structure/index.php?option=com_content&view=article&id=333&Itemid=925&subject=3131*
Level	*Single Course / Unit – Part of Masters (Second Cycle)*
Type of Institution	*Private*
Delivery mode	*Face to face*
Qualification awarded	*Elective course part of the MA Fine Art: Contemporary Art Practices programme (EQF 7)*
Key aspects **Description of the programme/ curriculum**	*This course deals with the practice of curating by examining the ways in which art has been displayed, mediated and discussed. The course will look at the structures and strategies behind different curatorial models, focusing on the history of exhibition - making and the development of ideas in each genre examined. Using case studies, the models of practice will include: the public museum or gallery; the biennial; interdisciplinary institutions; artist-led initiatives and institutional critique; art in the public realm; collections and the auction house; expanded museology; virtual curating and digital technologies; film and video; performance. The lessons also offer students the opportunity to build-up and present at a final stage an artist-led curatorial project that would enable them to understand and follow the contextual and conceptual operations, mechanisms, possible structures and logistics of exhibition-making.*
Learning Outcomes	*By the end of the course, the students should be able to:* - *Develop research methodologies in curatorial practice.* - *Reinforce awareness in art history and theory of the 20th and the 21st century as well as the history of art exhibitions.* - *Build working relations with fellow artists, art institutions, galleries and other venues of interest.* - *Demonstrate curatorial abilities in forming and presenting conceptual models.* - *Construct meaning and push forward new creative relationships.* - *Acquire skills in specialised scientific research and methodology.* - *Generate critical arguments using comparative analysis.* - *Develop a personal curatorial style and implement it in a personal project.* - *Use analysis and synthesis to develop advanced critical thinking.*

Occupational profiles of graduates (with examples)	*The majority of the employment opportunities lie within the local creative industries. Graduates from the MA programme may go into managerial creative posts such as Creative Coordinators, Cultural Producers, Design Managers or Art Directors in Graphic Design agencies, Interior Architecture, Art and Design related posts, as well as the media and will be working towards hybrid forms of visual and social research and creative production. Graduates can also pursue opportunities to initiate artist led, community-based projects or postgraduate doctoral studies.*

Title of the programme	Digital Art and Design
University, Country	*University of Nicosia, Cyprus*
Relevant URLs	*https://www.unic.ac.cy/digital-art-and-design-ma/*
Level	*Second Cycle level (Master)*
Type of Institution	*Private*
Delivery mode	*Face to face*
Qualification awarded	*MA Digital Art and Design, EQF 7*
Key aspects **Description of the programme/ curriculum**	*The programme provides a specialist, professionally focused study giving to students the opportunity to explore the dynamic interdisciplinary field of digital art and design. Students may engage in a range of elective courses including curatorial, photography and interactive design studies, interdisciplinary studios, and placements associated with art and design research projects. Through a sequence of high calibre practical and theoretical units, they will develop professional skills in creative digital art and design practice. Moreover, they will extend their learning and deepen their understanding of visual language concepts and systems within a digital environment.* - *Specific content/themes include curation: Demonstrate a critical understanding of contemporary curatorial practices, combined with a practical dimension of learning how to conceive, develop and materialise an exhibition/museum project.* - *Identify different models of curatorial methodologies (non-profit and public institutions)* - *Examine the broad field of the cultural and creative industries.* - *Discuss the importance of current and emerging technologies.* - *Question the impact of technology on creativity and the role of creativity in economy as well as its value for societies.*

Learning Outcomes	*Critically evaluate work in their field, including their own work, using professional terminology.* *Combine creative and innovative skills to produce work suitable for seeking opportunities in their chosen field of art and design.* *Take responsibility for their own professional and academic development.* *Demonstrate the expertise, independent skills and competence required to solve creative problems and be in charge of complex design processes.* *Recognise and assess the ethical challenges and the influence of major historical and contemporary cultural trends on art and design artefacts.* *Produce technically and aesthetically high-quality work based on interesting concepts that demonstrates an understanding of digital art and design principles.* *Appraise current research practices in their fields.* *Communicate and cooperate efficiently with others in design-related development processes, within and outside their own subject area.*
Occupational profiles of graduates (with examples)	*Art: Museums, galleries, digital art applications in the public and/or private sector.* *Commerce: New media project management, the IT industry, communication technology, web design, social media, interactive media production, digital photography and visualisation, electronic publishing, games, advertising agencies, digital design, advertising and info companies, museums, galleries.* *Education: Teach in IT and design industry companies, at high schools and universities in the public and/or private sector.*

Title of the programme	Digital Heritage and Landscape Archaeology
University, Country	*University of Cyprus, Cyprus*
Relevant URLs	*https://www.ucy.ac.cy/mscgidh/general-information*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MSc Digital Heritage and Landscape Archaeology, EQF 7*
Key aspects	*The Master's programme Digital Heritage and Landscape Archaeology of the University of Cyprus is a unique postgraduate program in the area of the E. Mediterranean that offers a concrete interdisciplinary*

Description of the programme/ curriculum	*academic course platform dealing with the application of spatial technologies and GeoInformatics in the wider domain of Digital Humanities. The program will act as an interface between New Technologies and the Humanities, exposing students to the latest spatial technological developments, providing hands-on training to different instrumentation and software.* The *Master's programme contests the mainstream of the traditional graduate studies in Humanities and it is targeting the following objectives:* - *Open a dialogue and create a concrete platform of collaboration between the technological and humanities disciplines.* - *Develop a dynamic environment of theoretical and practical training of high-qualified students.* - *Provide synergies between research, museums, academia, public and private agencies, where students will be able to apply their knowledge and carry out their research.* - *Offer an international educational setting, where students and researchers will interact productively and enhance the level of the research.* - *Create a new generation of Archaeologists and Historians that can deal with the current trends of geospatial technologies and geo-information systems.* - *Specific units: Introduction to Cultural Heritage Management, Advanced Topics in Digital Humanities, Computational and Analytic Techniques in the Humanities and Social Sciences.*
Learning Outcomes	*Comprehend the relation between environment, climate, and anthropogenic activities of the past with an emphasis on the settlement patterns and the exploitation of environmental resources.* *Obtain state-of-the-art skills that can be used in both field campaigns and laboratory analysis of surface survey and excavation results.* *Understand how the different spatial analysis tools operate to address questions related to the habitation patterns and the intra- and inter-spatial distribution of finds.* *Acquire the knowledge of the creation of maps (distribution of finds, geophysical measurements, geological and topographic maps, environmental maps, etc.) and comprehend the different spatial statistic algorithms to analyse them.* *Familiarise themselves with the actual research questions and take a critical stand on the statistical and spatial statistical results.*

	Obtain a practical hands-on training of software (GIS, network analysis, statistical analysis, mapping, etc.) and instrumentation/hardware (geophysical instruments, drones, cameras, GPS, etc.) that will make them competitive in their future profession (academia, cultural resources management, practical archaeology, etc.) and boost their career opportunities.
Occupational profiles of graduates (with examples)	*The particular knowledge and skills will equip students to deal successfully with the existing challenging conditions of the competitive job market in the humanities and provide them with a solid base of knowledge to continue their research at an even more advanced level. *This programme is more focused on application of spatial technologies and thus the career paths would be geared more towards this aspect and archaeology rather than Digital Curation.*

Title of the programme	Digital Methods for Humanities
University, Country	*Athens University of Economics and Business, Greece*
Relevant URLs	*https://www.dept.aueb.gr/el/dmh*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*Master of Science in Digital Methods for the Humanities, EQF level 7*
Key aspects **Description of the programme/ curriculum**	*Key aspects of this course include, digital documentation of cultural material, historical and theoretical review of Digital Humanities, digital infrastructure.* – *Understanding the functional needs, conditions and tools for digitisation in cultural heritage and other fields of application of the humanities.* – *Digitisation of images and 3D formats and covers digitisation of material and intangible culture.* – *Elective courses include, Interactive design and multimedia which covers virtual reality, immersion, augmented reality which can all be useful tools for a digital curator.* – *Students have the opportunity to gain oversight of the regulatory and legal issues raised in relation to information and digital media management.* – *To be able to develop their thinking about the role of the digital medium in the production of digital objects and knowledge and to understand the similarities and differences between tradition and innovation.*

	– *Develop and use model patterns, knowledge organisation systems and ontologies.* – *The programme is taught through weekly lectures, modelling and analysis tasks, repository development work and resource description and study and planning exercises at home.* – *Omeka platform for digital library management is used and students will have training on this system.*
Learning Outcomes	*Upon completion of their studies, graduates will have a good understanding and ability to apply digital methods in the fields of humanities and culture. Understand the role of digitalism in transforming research. Supplies for professional roles in curation and management of information resources with extensive use of digital media and techniques.*
Occupational profiles of graduates (with examples)	

Title of the programme	Archives, Library and Museology
University, Country	*Ionian University, Greece*
Relevant URLs	*https://ilam.ionio.gr/en/studies/undergraduate/courses/*
Level	*First Cycle (Bachelor)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*Bachelor in Archives, Library and Museology, EQF level 6*
Key aspects **Description of the programme/ curriculum**	*Key aspects of this programme include courses specifically on virtual museums, digital libraries, museum organisation, theme museums, human-computer interaction, multimedia applications. The programme lasts 4 academic years and at the start of each semester students are invited to register for all classes (compulsory and elective). After the first 2 years the programme offers students the opportunity to choose a more specific direction for their studies: Direction of Archives, Direction Librarianship or Department of Museology. The courses of each direction* *are divided into two streams: Basic Flow and Digital Flow.* - *Four laboratories and dedicated to the Department of Archives, Library and Museology.* - *Develop research, educational activities with an emphasis on Documentation of cultural and historical heritage, digital libraries and electronic publishing and museology.*

	- *The digital flow direction focuses on specific tools a digital curator would need. Courses provided such as Virtual Museums: key applications of new technologies at the service of museums, aims and objectives of virtual museums, available tools.* - *Museography – Museum Practice: The course details the relation between museology and museography, clarifies the roles of the curator, museologist and museographer in the modern museum, presents the principles and possibilities of museographic design, as well as the various museographic techniques.* - *Museum and Multimedia Applications: Computer software for the creation of multimedia applications and multimedia games of a museum character, as well as ways, possibilities and opportunities of dissemination of such applications. The course covers the presentation and evaluation of specific and selected examples of multimedia applications and games, as well as the procedures, methodology and implementation of such applications. Particular reference is made to interactive multimedia applications, experimental multimedia, augmented reality, pre-planned visit tailored to visitors' specific needs and characteristics, immersive and virtual environments.*
Learning Outcomes	*Understand the role of museum management and the basis of museum governance as well as cultural policy-making at national, European and International level. Recognise the benefits and problems arising from the of multimedia applications in a museum but also familiarise future curators with the standard types of technology used in virtual museums such as, guided tours, virtual reality, augmented reality. To understand the notions of virtual museum, digital museum, multimedia, interactive multimedia, online interactive multimedia, enriched reality, virtual reality and to describe the history of virtual museum development. Analyse digital museums in Greece and abroad and know the codes of digital museum ethics that apply internationally and nationally. Understand the importance of virtual museums in relation to the marketing and public of the museum. Graduates can organise, classify, search and present any kind of collection of items, from corporate records to museum exhibitions, from papyri to audio-visual media, from legislation to entertainment material, in conventional or digital formats, and to cover a very wide range of positions and employers.*

Occupational profiles of graduates (with examples)	*Graduates can organise, classify, search and present any kind of collection of items, from corporate records to museum exhibitions, from papyri to audio-visual media, from legislation to entertainment material, in conventional or digital formats, and to cover a very wide range of positions and employers.*

Educational pathways in Italy

Contributor/s of the analysis: Umberto Ferretti, Romina Nespeca, Ramona Quattrini, Chiara Mariotti – Polytechnic University of Marche

Date: May 10th, 2022

Data sources used for the analysis: course documentation, websites

References:

[1] Ministero dei Beni e delle Attività Culturali, *DM del 23 dicembre* . Accessed: May 10, 2022. [Online]. Available: https://www.beniculturali.it/mibac/multimedia/MiBAC/documents/feed/pdf/DM%20del%2023%20dicembre%202014-imported-49315.pdf

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[8] ICOM Italia, "Raccomandazione sui professionisti museali: lavoro sottopagato o non pagato," 2021. Accessed: May 10, 2022. [Online]. Available: https://www.icom-italia.org/wp-content/uploads/2021/06/ICOMItalia.Raccomandazione.LavoroSottopagatoONonPagato.15giugno.2021.pdf

Introduction

In the Italian scenario, as a reflection of the European one, museums must face digitisation in order to pursue their cultural and social mission in the future. This phenomenon is much discussed and studied, but after years of lacking policies, now it is flagrant the need to put in practice some guidelines, supporting to bring together Cultural Heritage and digital technologies. The tardiness of museum's digital transformation is also due to the difficulties encountered by the higher education system in modifying Syllabi toward the implementation of digital skills.

In the last decades a series of reforms and decrees have been provided by the Italian government to help the enhancement and digitisation of Cultural Heritage, revealing that it is a tangible process which enables the creation of new professions and opportunities for museums and other cultural institutions.

The Franceschini reform (2014) [1] brought about a radical change, which aimed to create a long-term "national museum system" with 20 museums in order enhance the dialogue between public and private cultural institutions. These museums have new power and a significant autonomy entrusted to a director surrounded by a number of professional figures, in line with standards defined by ICOM.

In 2018, the Italian Ministry of Cultural Heritage and Tourism approved the Decree n. 113 "Adoption of the Uniform Quality Levels for Museums, Monuments and Archaeological Sites" [2]. Around 5.000 Italian museums wanting to be part of the system will have to show evidence of compliance with the Uniform Quality Levels. The Levels identify three relevant macro-areas of museum work: Organisation; Collections; Communications.

In 2019, the Italian Ministry of Cultural Heritage launched a 'Three-year Plan for the Digitisation of Museums' [3] to provide all Italian museums with a coherent reference framework capable of guiding the adoption of digital solutions. It represents an essential challenge for Italian museums and at the same time an opportunity for growth and improvement for all museums and places of culture, regardless of ownership, size, region to which they belong.

In 2021, the "Piano Nazionale di Ripresa e Resilienza" (*National Recovery and Resilience Plan*) [4] allocates 500 million euros in grants for the digitization of public and private cultural heritage and for the creation of digital infrastructures and platforms for conservation and access to digital cultural resources.

The last study developed in 2021 by the Observatory for Digital Innovation in Cultural Heritage and Activities [5], promoted by the School of Management of the Polytechnic of Milan, reveals that 76% of museums have no strategic plan addressing digital innovation. The majority of investments concern services for museum's visit (47%) and for cataloguing and digitisation of collections (45%). The latter will become priority for future investments (24%), as well. In 2021, 95% of museums have created a website, a significant increase of 10% compared to 2020. Regarding social media, 83% of the museums are active at least on one social media channel (in 2020 the number was 76%). Facebook is the most used channel (from 76% to 79%), followed by Instagram (rising from 45% to

68%) and continually growing. The 70% of museums had enhanced the onsite visit with, at least, one digital tool. Specifically, are available QR-code/Beacon (33%), audio guide (32%), touchscreen (32%), app (24%), interactive installations (19%), virtual reality (10%), augmented reality (9%), mixed reality (3%) and chatbot (2%). These studies were realised on a sample of 476 Italian museums.

Regulation of the digital curator professional

One of the main sources is the Italian National Charter for Professional Training - drafted by the International Council of Museums (ICOM) in 2006 (reviewed in 2015) [6]. It states the necessity of professional upgrading for museum professionals and its vital importance as a factor in the life of a museum. To thrive in a constantly changing environment and to bridge the gap between museums and the different audiences, investment in continuous training must be a top priority.

The Observatory for Digital Innovation in Cultural Heritage and Activities report states that 56% has personnel concerned with digital innovation, but just 11% has a proper team of professionals. Although it is still a low rate, the study reveals that it is increasing (In 2020 it was 49%). In most of the cases these personnel are concerned with the management of social media channels.

According to the article “La mosta (im)perfetta” in the scientific magazine Art&Law [7] the curator is, in many cases, a freelance professional, specialised (with skills rooted in the history of art) and autonomous, who is occasionally involved for the realisation of one or more specific exhibition projects and with duties that include curatorship; rarely he/she is an employee of the exhibition body. The curator contract usually, according to the “typology of work contracts”, regulated by the Civil Code (pursuant to Article 2222 of the Italian Civil Code) is a self-employment contract between the curator and the institution.

The 2021 recommendation “Professionisti museali: lavoro sottopagato o non pagato” (Museum Professionals: underpaid or unpaid work) [8] provided by ICOM Italia, expresses robust concern about the spread of underpaid or unpaid work in museums and invites public administrations and all employers to recognize specific professional skills and to pay proper remuneration for the required functions, as provided in Italian Constitution.

In recent years a number of universities and other public and private institutions have faced a critical need to train these professional figures by providing courses of many kinds of levels. By analysing the application requirements for public competition for a permanent employment position, defined by institutions that manage national and civic museums and archaeological areas, enables a better understanding of the regulatory framework to work as curator:

- Knowledge in the history of contemporary art, museum conservation, management and enhancement
- Coordination of design, creation, programming and management of the works
- Ability to attract economic resources for the project
- Relevant First and/or Second Cycle degrees (according to Italian level of classes) such as:
    - LM-2 – Archaeology
    - LM-15 - Philology, Literature and History of Antiquity

- LM-19 - Information, Communication and Publishing Sciences
- LM- 45 - Musicology and Cultural Heritage
- LM-49 - Planning and Management of Tourism Systems
- LM-65 - Entertainment Sciences and Multimedia Production
- LM-84 - History of Art
- LM-89 - History and Document Sciences

The criteria adopted for the selection of Italian HE programmes follow this literature review and data collection.

Examples of programmes

Title of the programme	Economics and Management of Arts and Cultural Activities.
University, Country	*Ca' Foscari University of Venice, Italy*
Relevant URLs	*https://www.unive.it/pag/3212/ (Visited on May 5, 2022)*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MSc Computer methodologies for the humanities, EQF 7*
Key aspects **Description of the programme/ curriculum**	*The Master's Degree programme integrates expertise, research methodologies and professional approaches from humanistic and economic and managerial areas. From the A. Y. 2019/2020, the course is divided into two modules, one in Italian and one in English. The course focuses particularly on the evolution of the national, European and global artistic and cultural panorama. It also provides skills for the management of artistic and cultural organisations open to international exchanges.* *The course content, teaching methods and the characteristics of the degree thesis shape graduates who, among other things, can operate within the new connections between culture and business, in the critical relationship between creativity and innovation, with significant exchanges.*
Learning Outcomes	*Master's graduates will be able to work within companies, cultural institutions, museums, galleries, foundations, local authorities and other cultural organisations operating in general government, in senior positions in the planning, organisation and management of cultural activities and events. They will be capable of performing the role of assistant and head of project management and management control, assistant and head of marketing management and communication in the cultural sector, organiser of cultural events and activities, assistant to curatorship and artistic direction.*

Occupational profiles of graduates (with examples)	• *Assistant and head of Marketing Management and Communication in the cultural sector.* *Foundations, museums, theatres, publishing, audio-visual and entertainment sectors, creative roles in business within and outside the cultural sector;* • *Assistant and head of Project Management and Management Control in the cultural field.* *Foundations, museums, theatres, art galleries, publishing, audio-visual and entertainment sectors and programming and control in the creative industries;* • *Organiser of cultural events and activities.* *Public and private cultural institutions, museums, associations, foundations, theatres, art galleries, exhibition centres, cultural events agencies, creative industries;* • *Assistant to curatorship and art direction.* *Theatres, public and private exhibition venues, public and private cultural institutions, consultancy.*

Title of the programme	Engineering for cultural heritage
University, Country	*Interdepartmental Center of Engineering for Cultural Heritage CIBeC, University of Naples Federico II, Italy*
Relevant URLs	*http://www.cibec.unina.it/corso_perfezionamento.htm (Visited on May 5, 2022)*
Level	*Training course*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*MSc Engineering for Cultural Heritage, EQF 8*
Key aspects **Description of the programme/ curriculum**	*For over a decade the CIBeC has been committed to establishing a synergy between humanistic knowledge and technical-scientific knowledge, in order to promote a culture of conservation project based on historical and scientific bases.* *The training of professionals, officials and technicians in the field of Conservation of Cultural Heritage, in particular of historical buildings, it has singular connotations and specificities with respect to the academic preparation of engineers and architects. It requires acquisition preliminary of an interdisciplinary language that allows to combine the needs of historical knowledge and conservation with the technical-*

	scientific problems connected with the deterioration of the artifacts, their safety and usability. They will then be highlighted for the different specialized sectors, the peculiarities related to the problems of Cultural Heritage through the analysis of the most recurring cases. Finally, the fundamental criteria and guidelines for the conservation projects of architectural and historical-artistic artefacts will be provided. *Themes of the course:* - *Elements of archaeology and history of ancient architecture* - *Elements of architectural history* - *Construction types of architecture* - *Traditional materials and decay* - *The ancient construction concept* - *Traditional construction techniques* - *Geotechnics for historical buildings* - *Diagnostics for historical buildings* - *The conservation of the historical and modern buildings* - *Innovative materials and modern techniques* - *Multimedia methods of documentation* - *Applied physics for Cultural Heritage* - *Plant engineering for Cultural Heritage* - *Principles of lighting technology* - *Architectural design and conservation* - *Management and enhancement of cultural heritage*
Learning Outcomes	*The course is aimed at providing critical and operational tools in order to train professionals with specific technical-scientific skills in design and implementation of Conservation and Enhancement of Cultural Heritage interventions.*
Occupational profiles of graduates (with examples)	*N/S*

Title of the programme	DIGITARCH. Digital Collection Curator for Archaeology
University, Country	*Department of History and Cultures - University of Bologna, Italy*
Relevant URLs	*https://www.unibo.it/en/teaching/summer-and-winter-schools/2021/digitarch-digital-collection-curator-for-archaeology?fbclid=IwAR1XuMdsZFJIprSVEHaTKU8q1qUWBsbLC1zlfgpiYA4nCaUqz7A0EuAz5_8 (Visited on May 5, 2022)*
Level	*Postgraduate Course, Summer School*
Type of Institution	*Public*
Delivery mode	*Blended*

Qualification awarded	*MA Digital Collection Curator for Archaeology, EQF 8*
Key aspects **Description of the programme/ curriculum**	*Digital transformation is a reality that can no longer be ignored, which demands appropriate competences and knowledge, as well as skilled experts to meet the demands of this ever-evolving sector. Unfortunately, not all museums or cultural heritage sites are equipped with the right resources and skills to embrace this change. Archaeological Studies should take a leading role in this transformation. To do this there is a need for professionals adequately skilled to manage all the steps of the digital process, including gathering data on the field, the conservation of tangible or intangible heritage, storage management and developing and making archaeological collections accessible to the public within a museum environment. The Summer School is aimed at those who currently work, or are planning to work, in the cultural sector and would like to acquire or perfect their skills as a Curator of Digital Collections with a focus on material and immaterial archaeological heritage, ranging from museums to excavations. This professional role is already in high demand and is destined to become increasingly more so in the coming years.* *The main goals are to:* *• offer specialist training in the field of digital humanities applied to archaeology, aimed at acquiring skills and abilities in the management of both native and secondary digital data, from data gathering to communication and audience engagement;* *• promote a critical approach to the aims and methods, outcomes and trends of the digital shift in archaeology;* *• provide the tools necessary to compete in the world of work, under the guidance of professionals in the field, through multidisciplinary and international experiences;* *• encourage the development of a community of researchers and practitioners in the field of digital humanities applied to archaeology* *PROGRAMME:* *• Digital Collections for archaeology: introduction, best practices and case studies;* *• Digital Strategy and Audience Development for Museums;* *• Digital Accessibility and Sustainability;* *• Digital Business Modeling Communication and Storytelling for archaeological heritage: the museum experience.*
Learning Outcomes	*At the end of the course, students will have:*

	• *Acquired knowledge of international trends in the Digital Humanities, with a focus on its application to archaeology;* • *Gained applied practical skills in the sector, through classes led by international experts;* • *Enlarged professional networks and updated skills in line with recent labour market needs.*
Occupational profiles of graduates (with examples)	*N/S*

Title of the programme	MuseoLab
University, Country	*Department of History, Archaeology and Art History - Catholic University of the Sacred Heart, Milan, Italy*
Relevant URLs	*https://dipartimenti.unicatt.it/starart-bando-lombardia-plus-linea-alta-formazione-cultura-museo-lab-archeo-tech-art-market-museo-lab?fbclid=IwAR1cO6yfMKu0C61JylOu4fF-_q4d0XKPUuyrzL0Yg5SEGO36TGeTeWDQvKw#content (Visited on May 5, 2022)*
Level	*Training Programme*
Type of Institution	*Private*
Delivery mode	*Face to face*
Qualification awarded	*MA technologies and communication of Cultural and Archaeological Heritage, EQF 8*
Key aspects **Description of the programme/ curriculum**	*MuseoLab which intends to offer specific skills to include in the museum a figure of technical-organizational and logistical support who can assist, in various operational areas, the museum manager, the registrar, the press office manager. Museolab is part of a training program provided by the Catholic University due to the initiative LombardiaPlus, financed by the Lombardy Region with the contribution of the European Social Fund, that involved two other paths, Archeo-Tech and Art -market, which have been activated subsequently in order to offer a range of skills as articulated and complete as possible in the context of the enhancement of cultural heritage. MuseoLab represents a unique opportunity to acquire skills and tools for innovation in the museum field and, at the same time, offer significant response in a wider professional context.* *MuseoLab is divided into 4 training units, for an amount of 200 hours:* • *New technical skills for the museum operator in the field of archeology and works of art (80 hours)* • *Communication and advanced representation of archaeological and*

	artistic heritage (70 hours) *• Management and administration of artistic and archaeological assets for museums and temporary exhibitions (38 hours)* *• Active job search techniques (12 hours)*
Learning Outcomes	*Create new professional figures with advanced skills in the fields of digital and communication technology with the aim of supporting traditional activities of knowledge, preservation and promotion of cultural heritage.*
Occupational profiles of graduates (with examples)	*N/S*

Title of the programme	Digital Humanities
University, Country	*University of Salento, Italy*
Relevant URLs	*https://www.unisalento.it/didattica/cosa-studiare/percorsi/-/dettaglio/corso/LM70/digital-humanities (Visited on May 5, 2022)*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MA Digital Humanities, 120 credits, level 7*
Key aspects **Description of the programme/ curriculum**	*The main objective pursued by the course is to promote the integration between knowledge of the European cultural heritage and current developments in the ICT (Information and Communication Technologies) fields, by training new specialists and experts capable of satisfying the growing need for new contents posed by the Information Society and by bringing them to effectively master these skills in practical applications.* *The Digital Humanities course provides several modules that can be considered essential and significant for the Digital Curator training, such us:* *1st year* *• Cataloguing methods and promotion strategies for cultural heritage* *• Computer science for Cultural Heritage* *2nd year* *• Advanced project management* *• Digital information law* *• Virtual and augmented reality app development*

Learning Outcomes	*Holders of the "Digital Humanities" master's degree are expected to be employed as experts of application of digital technologies to the cultural heritage in public agencies, publishing houses, TV studios, web publishers.*
Occupational profiles of graduates (with examples)	• *Web application analysts and designers* • *Art experts* • *Curators and conservators of museums*

Title of the programme	New technologies for communication, cultural management and teaching of art history: for an immersive and multisensory use of Cultural Heritage a.a. 2021-2022
University, Country	*Department of History, Philosophical and Art History Studies - University of Rome Tor Vergata, Italy*
Relevant URLs	*https://web.uniroma2.it/it/contenuto/nuove_tecnologie_per_la_comunicazione__il_cultural_management_e_la_didattica_della_storia_dell__arte__per_una_fruizione_ (Visited on May 5, 2022)*
Level	*Professional Master (II level)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*MSc in "New technologies for communication, cultural management and the teaching of art history: for an immersive and multi-sensory use of Cultural Heritage, 60 credits, level 8*
Key aspects **Description of the programme/ curriculum**	*In the era of digital communication and shared accessibility, this master intends to direct graduates in the historical-artistic disciplines, who are projecting themselves into the world of work, towards that radical rethinking of the methodologies of teaching, research, dissemination, communication and of the marketing of art history that the increasingly widespread use of new technologies now makes it indispensable, to meet the needs of a contemporary public increasingly attracted by "immersive", "virtual", "multimedia" and "interactive" (experiences that risk, today, falling under the responsibility of operators from other backgrounds, without the necessary humanistic and historical-artistic skills, and most of the time unaware of the enormous potential, didactic and cognitive, which belong to modern approaches to fruition).* *The duration of the master is 12 months. The training activity provides 60 credits, equal to 1,500 hours of* *overall commitment for the student, of which 400 hours of so-called frontal teaching activity, ie face-to-face*

	of teachers (traditional lessons, guided workshops and exercises).
Learning Outcomes	*The aim of the Master is to provide young art historians with those transversal skills professionalizing that are particularly requested by the market of cultural, cinema and theatre, as well as from schools*
Occupational profiles of graduates (with examples)	*N/S*

Educational pathways in Portugal

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Date: May 20th, 2022

Data sources used for the analysis:

Publications and websites of museums and universities.
Interviews with museum staff of Bordalo Pinheiro (municipal art museum, https://museubordalopinheiro.pt), Costume Museum (national museum, www.museudotraje.pt) and Water Museum (run by the national company for water supply, https://www.epal.pt/EPAL/menu/museu-da-%C3%A1gua).

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Introduction

Digitalization is taken place in Portugal at a rapid pace. The ICT sector represents nearly 10% of national GPD [1], and experienced a shift in the last decade, with young and well qualified work forces, towards highly specified and innovative start-ups. Portugal is among the EU countries with high digital public services [2] and government is investing in digital transformation, in particular of public services and education [3].

The digitalisation of museums is assumed as a public service [4]. Aligning with this, digitalization found entry in museums, in particular, virtual tours and interactive exhibitions are the most common use. The museums embrace digital offers to address the affect and the senses as much as the intellect of the visitors [5]. The digital transition has good effects, it is not only inspiring new exhibition and curational practices, but it is also a lever for innovation and technological development. Besides the virtual tours, several museums offer D3 models, VR, 360˚ virtual tours, sound/videos, to offer a different experience and an immersion for visitors.

Websites and virtual tours are almost a standard and are intended to bring the exhibition closer (without walls) to the public [6]. The closure of museums, as a measure to contain the spread of

COVID-19, also leveraged the digitalisation of museums in Portugal. In fact, digital offers have noticeably increased since them, as virtual tours seem to make the best good sense in providing access to cultural goods during the pandemic. Museums faced with lockdowns had to adapt their services, and digital tools seemed to be a good (if not the only) alternative way. An interesting, example for keeping the interaction alive, is from Serralves Museum in Porto. During the lockdown, the curators organised virtual guided tours via video streaming through the museum and gardens [7]. There were no restrictions to the number of participants, or no entry fees are requested. This example can be taken as an effort to diminish the effects of physical distancing and avoid crowds.

Another positive aspect of digitalization is the fact that it enables museums to “exhibit” assets that are stored for different reasons but not showed to the public. On the other hand, once digital media became part of cultural services, it allowed (or forced) the training of professionals who are able to develop further digital resources from home - and this by need and self-learning as reported in the interviews: “Without this actual need, the development would take much longer”.

On the integration of digital technology, Matos [8] aptly states that “this pandemic has shown that [digitization] is an important way in accessing heritage”. However, “digital skills are not something that can be arranged overnight, they require training and investment”. This statement and the advancements on digital and mobile technology make clear that in order to explore new territories and offer different approaches, there is also a growing demand for professionals with knowledge and skills to lead process of digitalization and online curating.

Regarding training and pedagogy, Universidade Lusófona offers a post-graduation programme in socio-museology, with master’s and PhD degrees - widening the work field of experts to the context of society. The programme aims “to encourage and continue the process of the affirmation of Museology as an applied disciple area” [9], and at deepening the legal, theory and operational knowledge related to implementation of cultural policies that value museum actions. One of the subjects in both degrees is “Museology and Computer Science”. The course cover aspects as a general introduction to audio-video editing and production, creating 3D visualisation of objects and building a multi-touch surface LLP (Laser Light Plane). Actually, offering the subject “digital technology” started in 1999 when a database on small museums was created [10].

In Portugal, the Lisbon Nova University also offers a master’s degree in Museology [11]. In its programme there is no mention to applied computer sciences or digital technology. The University of Oporto offers a master’s degree and a PhD in museology [12,] without mentioning subjects on digital technologies. Other universities offer graduations in heritage studies, but not specifically on museology.

Beside these specific training opportunities, Universidade Lusófona also offers a master’s in Communication, Marketing and Digital Media, and PhD in Communications Sciences and Media Art, both are also dedicated to digital heritage and communication models from functional and structural point of views [13]. The Research unit CICANT has also research projects about and with museums [14], in particular to the issues of communication and exhibition patterns, expography, interactive exhibition.

Regulation of the digital curator professional

There is no specific legislation for a digital curator. The practice, reported in the interviews, shows that in small museums (i.e. Bordalo Pinheiro) the digital development is organised in a self-development, on learning by doing, for other institutions (i.e. Museu da Água) consultants (marketing agencies) are contracted for a specific work. This shows a limitation on both practices, then without training not all technology advancements can be fully applied and by contracting the outputs have to be clarified and fixed in the contract.

There is a growing debate on the digital development in the country. -few examples:

Law 47/2004 [15] addresses digital issues in its article 20, focusing on digital collection. However, as it is from 2004, it does not address digital museums or digitization of museums. However, there is debate on the subject.

ICOM-Portugal (international council of museums) that group the majority of museum professionals, is giving increasing importance to digitization, in particular through conferences and debates [16]. The government, as above mentioned, is investing in the digitization of museums as a public service[14] and several actions have been developed for debate and reflection on digitization in the context of museums [17] .

Research projects based on digitization and the use of information technologies are also being developed. They provide an important contribution to the development and increase of good practices in this area, ie. the Mu.sa project [18].

Examples of programmes

Title of the programme	Post-Graduation in Socio-Museology
University, Country	*Universidade Lusófona*
Relevant URLs	https://www.ulusofona.pt/en/masters/sociomuseology, https://www.ulusofona.pt/en/phd/sociomuseology,
Level	*Second Cycle (Master)* *PhD*
Type of Institution	*Private*
Delivery mode	*Blended – some events are online*
Qualification awarded	*Master's in (EQF level 7)* *PhD (EQF level 8)*
Key aspects **Description of the programme/ curriculum**	*It trains and build capacity of human capital for working in museums and museums practice.* *It is also aimed to develop academic research forces and creating and disseminating the knowledge that contribute to safeguarding and valorisation of heritage.*

	Also legal and operational knowledge regarding the implementation of public cultural policies is part of curricula. *The curriculum is built in a modular form allowing the student to perform the own research between the modules, students are involved in different activities, from lectures to workshops and ateliers.*
Learning Outcomes	*To coordinate museums and similar institutions.* *To integrate interdisciplinary teams in order to develop studies, projects, techniques and methodologies that may support the innovation in the design of museums' exhibitions.* *To develop public policies for culture, and in particular for museology.*
Occupational profiles of graduates (with examples)	*Director of cultural institutions, in particular museums, freelancer/manager in public administration, in cultural planning and management, researcher and professor for the fields of museology.*

Title of the programme	Master's in Communication, Marketing and Digital Media
University, Country	*Universidade Lusófona*
Relevant URLs	https://www.ulusofona.pt/mestrados/communication-marketing-and-digital-media
Level	*Second Cycle (Master)*
Type of Institution	*Private*
Delivery mode	*Blended – some events are online*
Qualification awarded	*Master's in (EQF level 7)*
Key aspects **Description of the programme/ curriculum**	*This master brings together under an umbrella different fields of a communication strategy: digital, communication and marketing, providing knowledge and skills, as well as a reflection on changes caused by technology development.*
Learning Outcomes	*Training of researchers and experts in communication, as well as the qualification and acquisition of deeper skills for professionals in the areas of (digital) communication and marketing.*
Occupational profiles of graduates (with examples)	*Director of cultural institutions* *Manager of Social Networks, Communication / Product Manager* *Consultant in Institutional and Strategic Communication.*

Educational pathways in Serbia + other countries

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Date: May 9th, 2022

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[4] Rulebook on detailed conditions, manner of functioning, connection and management of a single information system for museums - https://www.kultura.gov.rs/extfile/sr/8982/PRAVILNIK%20O%20BLIZIM%20USLOVIMA%20NACINU%20FUNKCIONISANJA%20POVEZIVANJA%20I%20VODJENJA%20JEDINSTVENOG%20INFORMACIONOG%20SISTEMA%20ZA%20MUZEJE..docx

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[6] Rulebook on the program and manner of taking the professional exam in museum activities - https://www.kultura.gov.rs/extfile/sr/8732/PRAVILNIK%20O%20PROGRAMU%20I%20NACINU%20POLAGANJA%20STRUCNOG%20ISPITA%20U%20MUZEJSKOJ%20DELATNOSTI1.docx

[7] Decree on Uniform Technical and Technological Requirements and Procedures for Preservation and Protection of Archival Material and Documentary Material in Electronic Form - https://www.kultura.gov.rs/extfile/sr/8291/UREDBA%20O%20JEDINSTVENO%20TEHNOLOSKIM%20ZAHTEVIMA%20ZA%20CUVANJE%20ARHIVSKE%20GRADJE%20U%20ELEKTRONSKOM%20OBLIKU..docx

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Introduction

The last decade can be recognised as a period of fast technological development worldwide, and a lot of cultural institutions from the Balkan region have been involved in this process, looking for the opportunity to preserve their rich collections of cultural heritage artefacts and thus protect history from oblivion. Suddenly, thanks to the achieved levels of technical knowledge and available technology, digital recording of every piece of history becomes truly possible, resulting in impressive usability and perceptibility of each media form. Following the European pioneers in technology development and museum transformations, the digitization process becomes an imperative of modern Balkan, including museums, university institutions, research organisations, and also touristic organisations and other beneficiaries. This new digital trend, fostered by the cultural environment that the process is developing, has generated the modern ways to reach the huge number of visitors, and also will be proven as a concept very soon in the next COVID-19 challenge.

Since the term “digitization” is used for variety of processes that transform real analogue objects to electronic or digital formats, we have to take into account that some of the media formats and hardware have been developed in the last century. Digital cameras, scanners and video recorders

are examples of technology development results and their influence led to a straightway redirection of users toward the adequate digital media. Cultural artifacts from the categories supported by developed software and hardware equipment were practically made available in digital formats at the beginning of this century.

The Balkan countries Serbia, Romania and Bulgaria started such digitization processes, collecting digital versions of books and important documents of their national libraries. Although the strategy and its legal framework was regulated later [1], the National Library of Serbia started the digitization in 2004 - the first in Serbia and one of the first in the region. The NBS digital library today includes 1.2 million digitized documents that represent a public national good. Four years later the Yugoslav Cinematheque began digitizing the film archive thanks to a donation from the European Agency for Reconstruction and Development. This year, at national level, the Ministry of Culture and Cults of Romania initiated a public policy for digitization and preservation of the cultural heritage. The National Library of Romania is involved in the definition and substantiation of this public policy, and the implementation of the Digital Library of Romania in compliance with the recommendations of the European Commission. The legal system governing cultural heritage in Bulgaria was built on several national laws and international conventions [2], and was recently enriched with the adoption of the Cultural Heritage Act (2009) [3]. This year is also considered as the official start of the digitization process in Bulgaria, and the first important results were presented in 2010 when the first phase of digitization of the National library St. Cyril and Methodius was finished.

Educational institutions in this region have also transformed their programs and syllabi, following modern trends and creative industry needs. Technical faculties were logically at the forefront of spreading the knowledge in the field of computer and digital sciences. In 2007, the Faculty of Electronic Engineering was legally accredited within the University of Nis to include courses of Computer 3D Modelling, Computer Animation and Special Effects in its educational programme of the undergraduate level of study. This was a beginning of the new educational era for the Balkan region that practically paved the way for research and education in new fields: Virtual Reality, Augmented Reality, Artificial Intelligence, Machine learning, Photogrammetry, 3D Geometry processing and related areas: Multimedia, Web Technologies, and Game Development. Programmes have been enhanced and enriched till today, in accordance with the achievements of science and the development of technology, so that all technical educational institutions in the region today offer modern programs at all levels of education.

Caused by permanent introduction of technical innovations, the notion of digitization has also been expanded in the field of digital 3D space, as have Mixed and Extended Reality. However, non-technical disciplines mostly remained rigid to technical improvement of educational syllabi, and some faculties (Faculties of Philosophy: University of Belgrade and University of Nis) do not include technical courses or any modern visual communication course in all their programme levels within all departments: History, Archaeology, Ethnology and Anthropology, History of Art, Sociology. Within the similar programmes of Romanian and Bulgarian biggest universities some courses of museum project management are included, but there is the border line between the mentioned educational fields and technical education. This situation clearly indicates the need for mutual

multidisciplinary cooperation in education, and especially confirms the need for solutions proposed by the DCbox project.

Regulation of the digital curator professional

There is no general law regulating the field of museology and the work of curators in Serbia, but there are bylaws in the form of rulebooks and decrees that regulate certain parts that are directly related to this area. The following regulations can be considered as mandatory conditions in defining the Digital Curator profession:

i) Rulebook on detailed conditions, manner of functioning, connection and management of a single information system for museums [4]; ii) Rulebook on the content and manner of documentation keeping on museum materials [5]; and Rulebook on the program and manner of taking the professional exam in museum activities [6].

On the other hand, the legal framework for dealing with digital materials is represented with the Decree on Uniform Technical and Technological Requirements and Procedures for Preservation and Protection of Archival Material and Documentary Material in Electronic Form [7]. The education itself and the programs that support it are defined in the Law on Higher Education of the Republic of Serbia [8].

Examples of programmes

Title of the programme	Computer Games Development - USER INTERFACE DESIGN
University, Country	*University of Kragujevac, Serbia*
Relevant URLs	*https://www.kg.ac.rs/dokumenti/studijski_programi*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*Master's in Computer Games Development*
Key aspects **Description of the programme/ curriculum**	*The course introduces the concepts of interaction between a user and a computer and design of user interface, as well as the assessment methods and techniques that can be used during the whole life cycle of computer interactive systems. It explains the principle and processes for documenting and implementing different development phases, including requests analysis, analysis of user needs, information architecture, development of prototypes, modelling and production.*
Learning Outcomes	*At the end of the course, students are expected to understand the significance of human factor, cognitive processes, context analysis, technical demands, their transformation into specifications and prototypes, and to successfully implement them during the development, implementation and analysis of user interface performances.*

Occupational profiles of graduates (with examples)	*Visual Prototype Design Engineer; User Interface Designer; Interactive Design Engineer;*

Title of the programme	Advanced Techniques in 3D Modelling and Animation
University, Country	*University of Nis, Faculty of Electronic Engineering, Serbia*
Relevant URLs	*https://www.elfak.ni.ac.rs/en/courses/master-academic-studies/computing-science-and-informatics*
Level	*First Cycle (Bachelor)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*Master's in Computer Animations*
Key aspects **Description of the programme/ curriculum**	*Mastering the basic knowledge necessary to use advanced procedures and techniques of computer 3D modelling and animation. Students in this programme will understand the advances in 3D Layout and scenes in 3D software including basics of rendering using Mental Ray, Antialiasing, GI, Final Gather. Illumination Shaders, Displacement, Ambient Occlusion. Learning the V-Ray and Mental Ray by rendering layers, render passes, contribution maps are the crucial concept of this curriculum with some basics of knowledge in hardware rendering, lighting and rendering optimization.*
Learning Outcomes	*Theoretical and practical knowledge in advanced techniques for computer 3D modelling. Developing the advanced skills in 3D modelling, programming the path of cameras and generating computer animations. Practical experience in the digital animation directing, planning and organizing the project of digitally generated and animated movies. Technical development of the project, compositing and final rendering techniques are the main outcomes.*
Occupational profiles of graduates (with examples)	*Computer 3D Artist; 3D animator; Virtual Environment Developer; Visualisation Engineer.*

Title of the programme	Advanced Data Analytics
University, Country	*University of Belgrade*
Relevant URLs	*https://ada.studije.rect.bg.ac.rs/*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Blended*

Qualification awarded	*Master of Data Analysis*
Key aspects **Description of the programme/ curriculum**	*This Master study programme focuses on the broad study area of quantitative sciences (statistics, computing, information sciences, or a combination of some of these fields), stressing integration of these areas in analysing different kinds of data and large volumes of data. It is designed for students with different backgrounds. The program has in its offer several courses related to mathematical foundations of data analytics, as well as several courses related to computer science and computing tools used in data analytics. In addition, several courses cover application of data analytics in different domains, like social and medical sciences.*
Learning Outcomes	*The need for this study program comes from a higher demand for experts in data analytics in different fields who can intensively use current data analytics technologies in their work. Job offers, marketplace flow, as well as trends in economy, society, public administration bodies, and other public institutions, undoubtedly point to that fact.*
Occupational profiles of graduates (with examples)	*Quantitative Researcher, Data Statistics Engineer; Big data analytics Engineer; Text Mining and Social Network researcher.*

Title of the programme	Digital Techniques, Design and Production in Architecture
University, Country	*University of Novi Sad, Faculty of Technical Sciences, Serbia*
Relevant URLs	*http://www.ftn.uns.ac.rs/n483427915/digital-techniques--design-and-production-in-architecture*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*Master of Architecture*
Key aspects **Description of the programme/ curriculum**	*Enabling the students to generate and visualize scene representing object or space design by using various digital techniques. Advanced techniques for digital images editing. Using images as channel and materials. Types of digital images, tones and colours. Texturization and material properties. The parameters of the real and virtual cameras. Properties of real light and light simulation. Rendering and texturing algorithms and tools. Rendering a designed object. Rendering a wider design scene. Creatin ambient in the scene.*
Learning Outcomes	*To apply acquired knowledge in the further educational process and professional work, as well as defining and explaining wider glossary of geoinformation technology. Understanding of the fundamentals of GIS: differences from related systems, application and history. Principles of GIS: data structure about Earth, mapping, basic concepts and characteristics of*

	GIS, how GIS operates and system architecture and components. Application of GIS: GIS data base structures, raster and vector models of data base, ``object`` data base, data collection and storage in GIS, analysis and presentation of collected data. Future of GIS. An Overview of leading GIS software.
Occupational profiles of graduates (with examples)	*Geoinformation Researcher, GIS System Engineer; Geo Data Analytics and Storage Engineer.*

Title of the programme	Engineering Animation, Augmented and virtual reality
University, Country	*University of Novi Sad, Faculty of Technical Sciences, Serbia*
Relevant URLs	*http://www.ftn.uns.ac.rs/n719608230/augmented-and-virtual-reality*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*Master's in Computer Graphic Engineering*
Key aspects **Description of the programme/ curriculum**	*Enabling students to create interactive visualizations and user intuitive interfaces for various types of augmented (AR) and virtual (VR) realities. Introduction and definition of basic concepts of interactive visualization systems. Theory and application of interactive visualization virtual reality (VR), augmented reality (AR) and mixed reality. Application of VR technology to organize, define and function the scene for interaction within 3D space. Technological procedure of applying extended reality with marker method and positioning method using GPS systems and gyroscopes. Simultaneous localization and mapping (SLAM) methods in augmented reality applications.*
Learning Outcomes	*To apply the acquired knowledge to specific tasks and problems in future professional work. To have skills to create a user interface for navigating and managing an interactive 3D model. Preparation of special effects in VR and AR. Work on creation of 3D ambiances with real-time software tools. Tools for creating interactive visualizations: Unity 3D, Unreal Engine, TurnTool, Adobe Premier.*
Occupational profiles of graduates (with examples)	*Computer Graphic Engineer, VR and AR artist; Game Frontend Application Designer.*

Title of the programme	Artificial Intelligence
University, Country	*Sofia University "St. Kliment Ohridski", Faculty of Mathematics and Informatics, Bulgaria*
Relevant URLs	*https://www.fmi.uni-sofia.bg/en/artificial-intelligence*

Level	*First Cycle (Bachelor)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*MSC in Informatics - Artificial Intelligence*
Key aspects **Description of the programme/ curriculum**	*The Master's Programme in Artificial Intelligence gives the graduates good theoretical knowledge in the field of intelligent systems and a variety of practical skills related to the application of AI methods and techniques in a wide range of areas of Informatics and IT. The curriculum includes courses in fundamentals of Artificial Intelligence, knowledge modelling and design of knowledge bases, machine learning, information retrieval, data mining and knowledge discovery in large datasets, natural language processing, image processing and pattern recognition, embedded and autonomous systems, neural networks and genetic algorithms, robot control, semantic technologies, and recommender systems.*
Learning Outcomes	*The educational objectives of the program include mastering of deep theoretical knowledge in the classical and some modern areas of Artificial Intelligence and acquisition of various practical skills needed for the application of AI methods and techniques in a wide range of fields of Informatics and Information Technologies.*
Occupational profiles of graduates (with examples)	*Engineer of Informatics; Artificial Intelligence specialist; Pattern Recognition Researcher*

Title of the programme	Multimedia systems
University, Country	*Politehnica University Timisoara, Romania*
Relevant URLs	*https://www.upt.ro/Universitatea-Politehnica-Timisoara_en.html*
Level	*First Cycle (Bachelor)*
Type of Institution	*Public*
Delivery mode	*Blended*
Qualification awarded	*Bachelor's in Computer and Information Technology*
Key aspects **Description of the programme/ curriculum**	*The main goal of this program is to understand the principles and functioning of modern computer and software systems in order to take part in their design and implementation. Computer and software engineering offers an immense variety of challenges and application areas, from developing programs for everyday devices to complex software systems; from applications in cultural heritage research or robotics to inventing new technologies for computer architectures and software development, or understanding human cognition to build truly intelligent systems.*

Learning Outcomes	*Our graduates have the needed knowledge and skillset required to fill specialty positions demanded by the job market, such as in network or system administration, development of mobile applications (Android/iOS), development of microcontroller systems, database design and administration, automated and robotic systems, antivirus software, network and software security, digital image and video processing, multimedia systems, distributed software systems, software or hardware project management as team or project leads.*
Occupational profiles of graduates (with examples)	*Multimedia specialist; Database designer; Mobile application developer; Software Security engineer.*

Educational pathways in Spain

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Date: May 11th, 2022

Data sources used for the analysis *course documentation, websites*

References:

[1] Law 8/2022 of 4 May on legal deposit.

https://www.boe.es/buscar/pdf/2022/BOE-A-2022-7311-consolidado.pdf

[2] Law 16/1985 of 25 June 1985. Spanish Historical Heritage Law.

https://www.boe.es/buscar/act.php?id=BOE-A-1985-12534

[3] Legislation on heritage conservation in the Spanish Autonomous Communities.

https://www.boe.es/biblioteca_juridica/codigos/codigo.php?id=175&modo=2&nota=0&tab=2

[4] National and international documents on conservation and intervention criteria

https://ipce.culturaydeporte.gob.es/conservacion-y-restauracion/documentos-nacionales-internacionales.html

[5] Red de Museos y Estrategias Digitales: https://remed.webs.upv.es

Introduction

The digital transformation in the field of cultural heritage is a recent process, which has been accelerated due to the COVID-19 pandemic. In Spain, the figure of Digital Curator does not yet exist, we are in a situation where the national scene is still digitizing, although more and more rapidly. It is important to stand out the effort made by various public and private institutions, led by the Polytechnic University of Valencia, with the creation of the Network of Museums and Digital Strategies (REMED).

The scope of REMED is to study, document and share the digital transformations that are taking place in Spain. REMED seeks to develop, in the medium-term, digital tools for museums and it seeks to develop a R&D project for the implementation of different tools for the digital dissemination of the contents of museums.

The interest on the digitizing process of CH can be seen in the digital transformation that many museums are currently undergoing, regardless of their size. First of all, there is the development of virtual tours in the museums, like the example of virtual tours of museums and archaeological sites of Andalusia, a platform that compiles all the virtual-tour experiences developed in the museums and sites of the Andalusian community, promoted by the regional Government of Andalusia. In addition to the institutional projects, there are others of individual nature, such as the “Museos de Madrid 360º” platform, virtual-tour of the Huesca Museum, the Cervantes House Museum (Valladolid), the Dalí Theatre-Museum (Figueras), or the virtual-tour of the Museum of Doña Mencía (Córdoba). Several of these examples are realized thanks to Google Arts and Culture Platform, which indicates the desire to imitate the digitizing trends that are already being developed at international level, introducing the Spanish cultural heritage into these trends. In the same way, not only the museums have been virtualized, but also the digitization of collections and archives is being carried out. The best example is the Spanish Archives Portal (PARES) for the digitization of the country's archival heritage. About the archaeological heritage, undoubtedly, the exhaustive digitization carried out by the National Archaeological Museum (MAN) stands out: the MAN allows access to its pieces organized into chronological-cultural periods. Other important websites about digitized collections are those one of the Prado Museum, the Malaga Centre for Contemporary Art, the Bilbao Art Museum, or the CSIC Collection of Scientific-Historical Instruments. These are just few examples of all those ones that exist on the Spanish scene, evidencing a virtualizing boost that will soon need the figure of the digital curator.

The speed of this development, and the firmness of its establishment in Spain, has brought many public and private entities to implement changes in their educational and training offers to embrace the digitalization of cultural heritage. However, the figure of Digital Curator does not yet exist in Spain, and therefore there are no educational modules and degrees regarding this professional figure. We highlight the master’s degree in Social Developments of Artistic Culture of University of Malaga, where in the module "Conceptual and instrumental references in research practice and cultural management" there is a subject on Digital Narratives and Curators. Despite this, we still cannot talk about the training of a figure of Digital Curator. We consider that, to understand the progress of national education on this field, we can establish a division between technical education, education related to the conservation and dissemination of digital cultural heritage and, finally, the management and conservation of cultural heritage in an “analogue” way, prevailing trend until not many years ago.

Regarding technical education, throughout the last years we have noticed a considerable increase in master's degrees and courses, both private and public, that have opted for teaching of virtualization software, virtual reconstruction techniques, etc. Among the many examples that exist in Spain, the courses about virtual reconstruction developed by UBU Abierta (University of Burgos)

stand out; the Master in representation and design in engineering and architecture, which despite its name, has strong links with the archaeological heritage (Interuniversity Master of the University of Malaga, Cordoba and Almeria); the Course of Cultural Heritage Digitization of UNED (National University of Distance Education); the Postgraduate Specialization Course in Digital Technologies for Geometric Documentation and Representation of Cultural Heritage (CSIC); specialized courses of Koré Formación; or the master's degree in Andalusian Artistic Heritage and its Ibero-American Projection of the University of Seville, which has a subject on Digital Technology and Artistic Heritage, where the main virtualization and reconstruction software are learned.

On the other hand, we cannot forget the great presence in this field of the University of Alicante, which has the master's degree in Virtual Cultural Heritage; the Specialization Course of Cultural Heritage Virtualization; the Postgraduate Course of Virtual Restoration.

Regarding the preservation and dissemination of digital cultural heritage, we find various masters such as the master's degree in Cultural Heritage Management and Museology (University of Barcelona), which delves into the conservation of cultural heritage and digital culture; or the Official Master's Degree in Humanities and Digital Cultural Heritage, of the Autonomous University of Barcelona, which introduces the student to the management of digital projects and digital cultural heritage. In a last area, we find the studies related to the management and preservation of cultural heritage, but without its digital aspect, such as the Master's in Municipal Cultural Heritage Management (University of Córdoba).

This summary of the Spanish panorama shows that digital cultural heritage is at a key moment, a time of transition. At the present time, the figure of the Digital Curator does not yet exist in Spain, although various master programmes are beginning to draw the blurred silhouette of what, in the future, it could become. But, without a doubt, it is important highlighting the incredible boost that, since the COVID-19 lock-down, has occurred in the virtualization of museums and in the digitization of their collections. Besides that, it is important to notice the increase of courses and masters related to cultural heritage digitization and conservation. We are at the right time to introduce the role of the Digital Curator in Spain which, taking into account the volume of virtualizations developed in such a short time, will begin to be an imperative necessity.

Regulation of the digital curator professional

Current legislation in Spain does not include the figure of the Digital Curator. The absence of this expert in our employment scheme has meant that, from a legal point of view, no laws or recommendations have yet been made regarding their work. However, Spain, as a member of the European Union and a country rich in heritage, has for many years now been adopting various laws that protect heritage and delimit the functions of heritage curators. An analysis of this legislation could indicate the path that the future regulation of the work of the Digital Curator will take in Spain. In our country, progress in heritage conservation/restoration has been closely followed. Good examples of this are the ICOMOS Charters, especially the Toledo/Washington Charter of 1986/87, or the Krakow Charter. It is also interesting to note the relationship between international regulations concerning archaeological heritage (Documents of New Delhi 1956, London 1969,

Lausanne 1990, Malta 1992) and Spain's support for these proposals, especially as one of the first signatories of the document that emerged in Malta in 1992.

In Spain, in terms of local regulations, there is Law 16/85 of 25 June 1985 on Spanish Historical Heritage, the matrix law, although each autonomous region has its own individual regulations, which have unique characteristics and are applied in their respective territories. Some examples of this legislation are Law 14/2007, of 26 November, on the Historical Heritage of Andalusia or Law 4/1998, of 11 June, on Valencian Cultural Heritage.

Very recently, in this year 2022, the new Law 8/2022 of 4 May was published, by which the National Library of Spain, which is responsible for the deposit and custody of bibliographic and audio-visual heritage, artistic and cultural creations, etc., has included digital heritage in its collections. This new law is a reflection of the interest in the preservation of digital heritage that exists in Spain and which, in a few years, will begin to flourish, bringing with it new regulations.

Examples of programmes

Title of the programme	Virtual Cultural Heritage
University, Country	*University of Alicante*
Relevant URLs	*https://cvnet.cpd.ua.es/webcvnet/planestudio/planEstudioND.aspx?plan=9207&lengua=E&caca=2017-18* *https://www.patrimoniovirtual.com/formacion/master-en-patrimonio-virtual/*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Online*
Qualification awarded	*MA Virtual Cultural Heritage (University of Alicante Internal Master). EQF 7*
Key aspects **Description of the programme/ curriculum**	*The Master provides a specific degree to all types of professionals that are dedicating to the documentation and enhancement of Cultural Heritage about the new technologies used in this field. All fields related to research, documentation and dissemination of Cultural Heritage are considered, taking into account the influence that the use of technologies from the field of engineering has had in recent years.* *The Master is organized as follow:* ● *Basic Module "Fundamentals on Cultural Heritage Virtualization"* ● *Advanced Module "Theory and techniques of Cultural Heritage Virtualization"* ● *Advanced Module "Theory and techniques of Virtual Restoration"* ● *Final Project and Conference on Virtual Heritage.*

Learning Outcomes	*The aim of the master is to complete the abilities and skills that the students have received in their previous degrees (Arts and Humanities, Engineering).*
Occupational profiles of graduates (with examples)	*The students will be able to work in the private or public sectors of Cultural Heritage specifically on the digital documentation and virtual dissemination of C.H.*

Title of the programme	Digital Humanities and Heritage
University, Country	*Autonomous University of Barcelona*
Relevant URLs	*https://www.uab.cat/web/estudiar/official-master-s-degrees/general-information-1096480962610.html?param1=1345803179474*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MA Digital Humanities and Heritage, EQF 7*
Key aspects **Description of the programme/ curriculum**	*This master's programme provides theoretical and practical training in the development of new technologies for digitizing bibliographic documents and the application of modern techniques for image analysis and 3D models of elements of historical and cultural heritage. The students will investigate how to advance in the design and interrogation of documentary databases and discover the new ways artificial intelligence may help in the processing of humanistic information. The students will acquire knowledge on new technologies for human-computer interaction that can lead to the creation of virtual museums and other forms of public dissemination of culture.* *The master programme is structured in 6 obligatory theoretical-practical modules, 1 professional placement module carried out in public or private cultural institutions or research groups with collaboration agreements and finally the master's degree dissertation. Student can choose one optional theoretical-practical module if they want to gain greater specialisation in the digital humanities or digital heritage. The theoretical-practical modules are:* ● *Applied Technologies I: from Data to Information* ● *Applied Technologies II: from the Pixel to Knowledge, Digitalisation and Computer Vision* ● *Applied Technologies III: Human-Computer Interaction* ● *Communication and Learning: User Experiences* ● *Creation and Management of Digital Projects on Cultural Matters*

	• *Heritage, Technology and Digital Humanities* • *Technology Applied to Humanities and Heritage Studies I: Digitalising the PastVirtual, Augmented and Mixed Realities* • *Technology Applied to Humanities and Heritage Studies II: Technologies in the Processing and Analysis of Words and Sound*
Learning Outcomes	• *Recognise the main challenges in the area of study of digital humanities and heritage. Design and plan impact and cultural innovation projects which use the possibilities offered by information and computer technologies.* • *Manage cultural projects that use information and computer technologies in any area.* • *Recognise and use the appropriate computer tools for the acquisition, digitization, indexing and processing of documents and historical, artistic and literary materials.* • *Analyse and extract relevant scientific information from documents and historical, artistic and literary digitized materials.* • *Design extended reality systems for use in social and humanistic studies and cultural projects.* • *Incorporate the use of computer technology in the communication and transmission of culture to specialist and non-specialist audiences and evaluate the results.* • *Evaluate the possibilities offered by technology in the production of new forms of cultural, social and humanistic creation and co-creation.* • *Incorporate educational methodologies for communication and learning of the content of the projects related to digital humanities and heritage.*
Occupational profiles of graduates (with examples)	*The master's degree provides the skills and training to work in the creation and management of digital cultural heritage.*

Title of the programme	Cultural Heritage Management and Museology
University, Country	*University of Barcelona*
Relevant URLs	*https://www.ub.edu/portal/web/geography-history/university-master-s-degrees/-/ensenyament/detallEnsenyament/6257761*
Level	*Second Cycle (Master)*

Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MA Cultural Heritage Management and Museology. EQF 7*
Key aspects **Description of the programme/ curriculum**	*The master's degree in Cultural Heritage Management and Museology offers professional training in preparation for a variety of roles in museums, heritage institutions, public bodies and cultural enterprises, encompassing emerging professions and new profiles in the field of heritage management. It is fundamentally professional in focus, aiming to give students the theoretical and practical training through which they will acquire the competences to find employment in the heritage sector. It is also a markedly interdisciplinary programme, reflected both in its organization and in the course content itself; the teaching staff are drawn from fourteen different departments across seven faculties.* *The course focuses on two main areas: a) the design and organization of exhibitions and the valorisation of monuments and heritage sites using innovative techniques and strategies; b) the identification, analysis and appraisal of the economic, legal, political, social and cultural logics that have a bearing on heritage planning and management, and the use of this expertise to design and carry out specific interventions.* *The modules of the course are:* ● *Culture heritage and museums* ● *Conservation, museography and heritage presentation* ● *Planning and heritage management* ● *Didactics and heritage intervention tools* ● *Legal and economic tools in heritage management* ● *Methodology and research tools in cultural heritage and museology*
Learning Outcomes	*This master's degree is designed to fulfil two main objectives: providing professionals and individuals interested in cultural heritage with the conceptual knowledge and practical experience necessary to manage cultural heritage; transferring the necessary theoretical and methodological tools and a sound base of knowledge to those interested in a career in applied research or in cultural heritage and museology. The programme also offers a research specialization linked to the work of various research groups and the goals of the corresponding doctoral programme.*
Occupational profiles of graduates (with examples)	*The master's degree provides the skills and training to work in the management, mediation and conservation of cultural heritage:*

	• *Museums: conservation, management or administration of services and technical staff, etc.* • *Cultural organizations and cultural heritage: design of museum projects, management plans, exhibitions, etc.* • *Public service and heritage institutions: management and administration of services, equipment and heritage projects.* • *Curation, planning, design and organization of exhibitions.* • *Research in museology, heritage management, museology, teaching and dissemination of heritage, public studies, etc.*

Title of the programme	Management of Heritage by the Municipality
University, Country	*University of Cordoba*
Relevant URLs	*https://www.uco.es/estudios/idep/gestion-patrimonio-municipio#presentacion*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MBA Management of Heritage by the Municipality. EQF 7*
Key aspects **Description of the programme/ curriculum**	*The programme covers a multidisciplinary field, the management of Cultural and Natural Heritage from a municipal perspective, focused on the closest heritage that allows identifying the collective identity of a community.* *The three curricula of the Master (Municipal Policies and Facilities, Enhancement of Cultural and Natural Heritage, Natural Heritage and Environmental Quality) have as fundamental aim the training of students to address the analysis of heritage in the territory in order to establish the appropriate strategies to conserve it and enhance its value, responding to the professional profile of the Heritage manager in Europe. The master's degree aims to cover the demand for professionals who, from the public and private spheres, promote initiatives in the municipal area aimed at the development and promotion of Culture, serving as the local nexus agent with other spheres of the Administration.*
Learning Outcomes	- *Prepare qualified professionals to plan strategies that promote the economic, cultural and social development of the territory based on the enhancement of its cultural heritage.* - *Prepare professionals who, following the guidelines of the European Community, encourage cultural tourism policies and*

	strategies within the perspective of a balanced and sustainable use of heritage, preserving the possibilities of use for future generations and applying specific models of development of cultural tourism without reproducing the usual schemes of mass tourism. - *Prepare professionals who, based on the potential of the territory's heritage, carry out a diagnosis of natural resources and associated cultural resources to achieve greater profitability through programs that protect and value the heritage.*
Occupational profiles of graduates (with examples)	*The main aim of the master's degree is the training of students to approach the analysis of heritage in the territory in order to establish the appropriate strategies to preserve it and enhance its value, responding to the professional profile of the Heritage manager in Europe.*

5. Other inspiring examples

The desk research conducted in further countries other than the ones analysed in the previous chapter, and included learning provision by Higher Education Institution (HEI) in EU and non-EU countries, highlighted the following key aspects:

- Across EU countries not covered in the previous chapter and outside the EU, many are the available courses or master programmes in digital curation, but very seldom are they related to Museums and Arts, and more frequently to the general concept of digital curation across domains.
- In this context, it is quite hard to identify courses in the EU. Interesting examples have been instead identified in Canada, US and the UK.
- In the identified cases, Digital Curation is seldom the main subject of a degree or master's course, rather it is a course, or a module, offered in the frame of degree or master programmes focused on subjects like Museum Studies or Information Studies.
- There is no single recipe for the learning mode: face to face and online delivery are foreseen in the identified examples and often the blended solution is adopted, with initial (and/or final) face to face sessions integrated by online delivery.
- Given the specificity of the area addressed, some courses foresee in presence visits to museums and/or in presence/virtual seminars with international or national experts in the field. The flipped classroom approach is also often adopted.
- Learning outcomes differ one from the other, but most of them cover strategic, practical and technical aspects linked to the digital curator profession.
- Learning materials, when available from the course websites, vary from articles, books and papers to videos, podcasts and presentations.

- It is not crystal clear from the available information whether group work is foreseen, but the general impression is that individual work is expected from students.
- The identified courses/masters are available in general to future and current professionals in the field.

Below, some examples are provided on the nature and features of the courses offered:

Canada

Title of the programme	**Curational Practice – a course developed in the frame of the Master on Information Studies**
University, Country	*University of Toronto, Canada*
Relevant URLs	*https://ischool.utoronto.ca/wp-content/uploads/2017/03/MSL2000H-2021-Fall-Phillips-Syllabus.pdf*
Level	*Master's in information systems/Museum Studies*
Type of Institution	*Public*
Delivery mode	*Face to face, with BYOD recommendation*
Qualification awarded	*NA – this course is part of a master and no exam is required, nor qualification awarded. Grading policy available here: https://www.ischool.utoronto.ca/wp-content/uploads/2020/08/grade_interpretation_revised_August2020.pdf*
Key aspects Description of the programme/ curriculum	*"The course looks at the different roles played by curators (collector, researcher, activist, story teller, knowledge keeper) in different types of exhibiting spaces (from art galleries, to museums, to heritage and public spaces), and reflect on the many ways of curating collections. To introduce students to a range of key topics in the field of curatorial studies, including collection development, curatorial research methods, limits of authority, interpretative strategies, cultural representation and exhibition historiography.* *Course objectives:* - *To actively explore curatorial practice in a range of disciplines and contexts, including art, histories and heritage, sciences, through readings, class discussions, guest speakers and site visits.* - *To develop a range of practical and analytical curatorial skills, including curatorial research, specialist modes of writing, and articulating and critiquing curatorial frameworks.* - *To introduce students to a range of museums, galleries and relevant specialists in the Toronto-area."*

	A flipped-classroom approach is adopted: learners are required to prepare for classes reading specific material for each lesson and listening to a podcast of their choice among a pre-defined list, so they are ready for discussion. After the first introductory lessons, most of the lessons include either a visit to a local museum or a meeting with an artist or a curator. There are two intermediate and one final assignment. Assessment weight as follows: - *Assignment 1: 20%* - *Assignment 2: 30%* - *Final assignment: 40%* - *Participation: 10%*
Learning Outcomes	*"By the end of the course, students will be able to :* *- Demonstrate critical understanding of curatorship and curatorial practices in different cultural, social and political contexts;* *- Reflect critically on the relationships between curators and museum / gallery publics;* *- Demonstrate writing and research skills for a variety of curatorial activities; Identify contemporary curators, artists and scholars in the field of curatorship and discuss their respective impacts on contemporary curatorial practice. "*
Occupational profiles of graduates (with examples)	*See:* *https://ischool.utoronto.ca/current-students/careers/career-outcomes/* *It is interesting to know that Digital Curator as such is not mentioned as a specific occupational profile.*

USA

Title of the programme	**Museum Studies, MA/Digital Curation**
University, Country	Johns Hopkins University - Zanvyl Krieger School of Arts and Science
Relevant URLs	https://e-catalogue.jhu.edu/arts-sciences/advanced-academic-programs/programs/museum-studies-master-arts/museum-studies-ma-digital-curation-certificate/
Level	Second Cycle (Master)
Type of Institution	Private
Delivery mode	Almost fully online (two weeks on site seminar+online)
Qualification awarded	A certificate provided in the frame of the MA in Museum Studies

Key aspects **Description of the programme/ curriculum**	The course is addressed to students who are interested in pursuing an MA in Museum Studies and are also interested in the creation, management, and preservation of digital assets in museums may enrol in this combined program. Below, the description of the full programme in museum studies is provided as no details are available for the specific course in digital curation: **Core Course - Required:** Two-Week Onsite Seminar **Core Courses – Customizabl**e- Select one of the following: Exploring Museum Professions Museums in the Digital Age Select three of the following: Introduction to Museum Education Exhibition Strategies The Business of Museums History & Philosophy of Museums Museum Evaluation and Audience Research Collection Management **Electives-** Select five of the following: Museums in a Global Perspective Museums and Community Engagement Museums, Law, and Policy Museum Controversies: Ethical Issues in Museums Museums, Race, and Inclusion Accessibility in the Museum Evaluation Projects and Practice Architecture of Museums Exhibition Design, Construction, and Documentation Practice of Public History Conservation-Restoration: A 21st Century Approach Museums, Libraries, and Archives: Issues of Convergence for Collecting Institutions

	Curatorship: Principles and Practices Living Collections Curating Online Exhibitions and Experiences Preservation of Analog and Digital Photographs Material Culture and the Modern Museum Educational Programming for Museum Audiences The Practice of Museum Publishing Expanding Roles of Museum Marketing and Communications Fundamentals of Museum Fundraising Developing Effective Digital Engagement Projects for Museums Social Media Strategies for Museums Introduction to Archives Collection Management Systems Cataloguing Museum Collections: History, Standards, and Applications Digital Preservation Foundations of Digital Curation Managing Digital Information in Museums and Archives Digital Curation Certificate Internship Digital Curation Research Paper Leadership of Museums Project Management in Museums Museums, Finance, and the Economy Private Collectors, Collections, and Museums Culturally Specific Museums Provenance Research: Connecting Histories Science, Society, and the Museum Innovation and the Modern Museum Museums of the Americas: Facing Challenges in the 21st Century Museum Internship

	Museum Projects
Learning Outcomes	- *Describe and discuss the roles and responsibilities of museum practitioners.* - *Exhibit knowledge of actual museum work through practical experience.* - *Generate and assess solutions to current challenges facing museums.* - *Design and implement collaborative projects in the team environment of the 21st-century museum.* - *Demonstrate the ability to participate in and facilitate the museum's multifaceted role in a global society.* - *Analyse methods to meet the needs of diverse museum audiences.* - *Evaluate and apply innovative uses of technology in museum practice.* - *Synthesize strategic planning principles in the creation of a 21st-century museum practice*
Occupational profiles of graduates (with examples)	*Museum professional*

UK

Title of the programme	**PGCert in Digital Curation (Course)**
University, Country	*University of Salford (UK)*
Relevant URLs	*https://www.salford.ac.uk/courses/postgraduate/digital-curation*
Level	*Single Course - It is a course addressing early career or established curators willing to update and upgrade their skills*
Type of Institution	*public*
Delivery mode	*Online*
Qualification awarded	*Post graduate certificate in Digital Curation*
Key aspects **Description of the programme/ curriculum**	*An 8 months course organised along two main modules:* *- Digital curation and contemporary art: curating in context* *"What is digital curation? Attempts to answer this core question are at the heart of this module, which provides different perspectives from tutors who have professional experience as digital curators, art curators, museum curators, archivists, and digital preservation specialists. With this broad view on digital curation, you will then work on a specific curatorial project through individually designed 1-to-1 tutorials to apply some of the proposed models for digital curation, engaging some of the curatorial tools available for digital preservation and/or online exhibition".* *- Digital curation and contemporary art: collecting and archiving* *"What are the differences and similarities between collections and archives? How do collections differ from archives? How do documents become collections that can be archived? And how are documents and documentation different concepts in this context? Working through these questions with a range of digital curation professionals you will acquire an advanced understanding of the processes and terminology involved in digital curation through archival techniques. With this specific approach to digital curation processes you will then work on a specific curatorial project through individually designed 1-to-1 tutorials to apply this through some of the curatorial tools available for digital preservation and archiving".*

Learning Outcomes	*According to the course web page, learners will:* - *Develop career-enhancing theoretical knowledge and practical skills in digital curation* - *Undertake a profile-raising practice-based curatorial residency and showcase your work with a contemporary art organisation* - *Validate and enhance their curatorial practice within an online international network* - *Build a portfolio of work that can be shared with potential employers as they progress their career*
Occupational profiles of graduates (with examples)	*"Studying on this PGCERT digital curation and contemporary art postgraduate course is designed to enhance your career prospects. You may decide to work in the gallery or arts sectors, developing programmes that engage with digital curation. As part of this course, you'll gain a clear understanding of the roles available to you upon graduating, from digital curator to collection manager".*

Title of the programme	**MSc Digital Curation**
University, Country	*Aberystwyth University*
Relevant URLs	*https://www.aber.ac.uk/en/dis/courses/digitalcuration/*
Level	*Second Cycle (Master)*
Type of Institution	*Public*
Delivery mode	*Face to face*
Qualification awarded	*MSc*
Key aspects **Description of the programme/ curriculum**	*Focus on: Knowledge of the values and principles which underpin digital asset management; and the policies, procedures and governance required to ensure the integrity of digital material over time will be acquired through lectures, seminars and practical application.* *Face to face lessons complemented with visits to cutting-edge organisations and lectures from leading professionals.*
Learning Outcomes	*This degree will equip you with the strategic, practical and technical skills for a career in digital curation*
Occupational profiles of graduates (with examples)	*Digital archivist, digital preservation specialist, digital projects manager and research data management.*

Title of the programme	**Digital Curation**
University, Country	*UCL*

<table>
<tr><td>Relevant URLs</td><td>https://www.ucl.ac.uk/information-studies/inst0045-digital-curation</td></tr>
<tr><td>Level</td><td>A course delivered within the Information Studies (Faculty of Arts & Humanities)</td></tr>
<tr><td>Type of Institution</td><td>Public</td></tr>
<tr><td>Delivery mode</td><td>Face to face</td></tr>
<tr><td>Qualification awarded</td><td>Course offered to all postgraduate students in Information Studies. Not compulsory. Intermediate ICT skills are a prerequisite.</td></tr>
<tr><td>Key aspects
Description of the programme/ curriculum</td><td>
<table>
<tr><td>Class 1</td><td>Introduction</td></tr>
<tr><td>Class 2</td><td>Authenticity</td></tr>
<tr><td>Class 3</td><td>Differences of scale</td></tr>
<tr><td>Class 4</td><td>Digital repositories and standards</td></tr>
<tr><td>Class 5</td><td>Different contexts</td></tr>
<tr><td>Class 6</td><td>Evaluating technology</td></tr>
<tr><td>Class 7</td><td>Communities</td></tr>
<tr><td>Class 8</td><td>Metadata</td></tr>
<tr><td>Class 9</td><td>Advocacy</td></tr>
<tr><td>Class 10</td><td>Conclusion</td></tr>
</table>
</td></tr>
<tr><td>Learning Outcomes</td><td>- Articulate the (on-going) need to preserve digital material to everyone
- Devise and maintain appropriate solutions to preserve digital material over the long-term
- Keep in touch and up to date with the fast-moving world of digital curation and beyond, ensuring that you remain fully engaged in the communities in which you find yourself operating</td></tr>
<tr><td>Occupational profiles of graduates (with examples)</td><td>NA</td></tr>
</table>

In addition to the formal learning provision by HEIs, some non-formal interesting examples have been found, emerging from projects, associations or networks directly or indirectly involving museums:

- the Museum Learning Hub, a nationwide initiative organized by the six U.S. regional museum associations and dedicated to providing free, self-paced training resources for small museums, aims to support small museums seeking to overcome barriers to audience engagement and educational program delivery in a post-pandemic environment. The resources available on the Museum Learning Hub address a range of topics, including Toolkits and resources for small museums willing to address the challenge of digital transformation. The following modules are available, with open access, to museums and anyone interested:
  - Module 01 – Digital Accessibility and Inclusion for Museums
  - Module 02 – Live Streaming for Museums
  - Module 03 – Managing Digitization Projects for Museums
  - Module 04 – Managing Website Projects for Museums
  - Module 05 – Virtual Exhibitions for Museums
  - Module 06 – Podcasting for Museums
  - Module 07 – Video Production for Museums
  - Module 08 – Audiences and Analytics for Museums
  - Module 09 – Social Media for Museums
  - Module 10 – Digitizing 3D Collections for Museums
- the Cultural Heritage Imaging is a non-profit U.S. corporation offering a variety of services for the development and adoption of practical digital imaging and preservation solutions including short, in presence training opportunities and workshops addressing individuals interested in related specific topics.
- the MIAT (Multiverse Institute for Arts and Technology) in Italy offers the Immersive Storytelling & Metaverse Masterclass, a 60 hours full immersion bootcamp, running in small groups and covering the fundamentals of immersive technology, the metaverse and creative virtual production.
- the DIGIMUS project is empowering museum professionals with digital skills and organises a workshop series on themes relevant to the digitalisation of museums. The project targets at museum professionals in the Baltic and Nordic regions. It aims to map and strengthen the existing gap in professional competences and skills that will facilitate a more sustainable and multifold integration of digital collections into museum services.

6. Conclusions and way(s) forward

The “Digital Curator Mapping & Design” report intends to serve as white paper for:

- students, who intend to embark in courses of study, and subsequently in careers, linked to the digital transformation of museums;
- curators actively involved in digitization projects;
- museums wishing to upgrade and re-think the visitors' experience according to new digital trends and possibilities.

Focusing of the geographic area of the Mediterranean region, three main domains, related to the digital evolution of the curator profile, have been analysed in order to highlight common elements, characteristics and differences.

Specifically, the following topics have been studied:

- National and international legislation in force,
- Digital transformation of museums,
- Educational programs offered by academic institutions.

National and international legislation.

By analysing the national and international legislation frameworks to which the DCbox members countries abide, it can be stressed that the Digital Curator profile per se is not yet a defined and regulated professional figure with required specific skills. Although, national and international laws and policies are now frequently including and promoting the needs to introduce digitization efforts in the cultural heritage domain, each country still rely on generic guidelines, where initiatives are often driven by museums themselves and international associations (i.e., ICOM and ICOMOS).

Italy, among all DCBox partners, appears to be the country which has achieved a more structural integration of digital skills, as requested asset for a museum curator. As highlighted in the Italian National Charter for Professional Training indeed, the necessity of professional upgrading for museum professionals is of vital importance in the life of a museum to bridge the gap between museums and the different audiences. However, this not always reflects in a diffuse endorsement of the recommendations since as stated by a recent survey [6], although museums have 56% of the personnel concerned with digital innovation, just 11% have a proper team of professionals.

In other countries like Cyprus, Greece, Serbia, Romania, Bulgaria, Spain and Portugal the profession is still under discussion and reveals a gap in the definition of the profile of a Digital Curator.

In Cyprus, the role of Curator of Antiquities falls under the Department of Antiquities and the national Antiquities law. Serbia relies on rulebooks and decrees regulating certain parts that are directly related digitisation of heritage assets. The Portuguese Law 47/2004 focuses on digital collection without addressing digital museums or digitization of museums. In Spain, each autonomous region has its own individual regulations, which have unique characteristics and are applied in their respective territories.

Digital Transformation of museums.

In order to understand the extent of the use of digital applications in museums and heritage sites, each partner conducted a mapped exercise analysed local case studies. The results were assessed both from a qualitative and quantitative point of view.

From a qualitative perspective, parameters such as: (I) users' engagement, (ii) non-specialised equipment needed (consumer-grade 360 cameras), (iii) maximisation of outreach capabilities were considered as drivers in the decision for and implementation of digital features in museums.

Accordingly, the survey highlighted the use of web applications (I.e., virtual-tours) horizontally distributed among all partners' country.

It can be observed that as the need to provide specialised equipment and skills increases, the number of specific classes of application decrease. The latter is probably due to the lack of professional expertise and the costs' raise for production of the digital content, its configuration complexity on site, and (daily) maintenance (immersive cave, headset mount display).

Sustainability of the digital content in the long term also emerged as an element of concern. Formats indeed can change rapidly as designers alter features, and individual file formats can be very complex i.e., Flash Player no longer being supported (World Heritage Sites of Cyprus)[1].

Educational programmes offered by academic institutions.

To describe, evaluate, and compare the current state of educational programmes offered by academic institutions in the Mediterranean region, the main curricula were mapped and analysed with the final goal of structuring a preliminary index of the DC training roadmap. Each partner has collected the most relevant information about bachelor's, master's, PhDs, and advanced courses which can effectively contribute to shape the digital curator professional profile.

Although many of them include specific content-related modules (such as the Digital Curatorship module inside the Master's in Digital Cultural Heritage of the Cyprus Institute or the postgraduate Summer School in Digital Collection Curator for Archaeology of the University of Bologna: a course available at the University of Cordoba in the framework of the Masters of Science in Information Systems/Museum Studies which looks at the different roles played by the curators) the survey highlighted the lack of a comprehensive educational offer which includes all the potential skills needed to train the future Digital Curators as an emerging professional profile able to tackle and manage all the new challenges which have been emphasised by the prolongation of COVID-19 pandemic and the consequent need to rely on digital, smart and connected museums.

Alarmingly the only two complete and more organic programmes targeted to Digital Curation have been identified outside the boundaries of the European arena. The MA in Museum Studies/Digital Curation of John Hopkins University (USA) is addressed to students who are interested in the creation, management and preservation of digital assets in museums.

The MSc in Digital Curation offered by the Aberystyth University (UK) focuses on the principles promoting digital asset management, the policies, procedures and governance required to ensure the integrity of digital material over time.

7. Recommendations (D1.4)

As stressed at the DCbox proposal stage, and confirmed by the outcomes of this study, to date there is no single, unanimously agreed reference framework to empower learners with skills,

[1] https://whc.unesco.org/cyprus2009/index-en.html World Heritage Sites of Cyprus

competences and expertise a DC should master, such as a synthesis of technical knowhow and humanistic background. This chapter of recommendations also constitutes a preliminary index of the Digital Curation roadmap.

The main areas which have been identified as strategic for training the next generation of Digital Curators can be summarised as follow:

(Digital) Humanities (DH): Incorporate educational methodologies for communication and learning of the digital humanities and heritage related projects; Recognise the main challenges in the area of study of digital humanities and heritage (technical and ethical).

(Digital) Museology: Knowledge of skills in the application of the intellectual foundations of museum work; transformations of the museums' role in contemporary societies due to the integration of technological interfaces when interacting with knowledge; understanding of the new relationship of museums with their audiences, reflecting on new educational models and opportunities offered by technology, and critical use of ICT for the creation of new curation models for the museum of the future.

Digitization and VR: Digital documentation of cultural material; knowledge to use advanced procedures and techniques of computer 3D modelling and animation; create interactive visualizations and user intuitive interfaces for various types of augmented (AR) and virtual (VR) realities.

(Digital) Management: Role of museum management and the basis of museum governance as well as cultural policy-making at national, European and International level; regulatory and legal issues raised in relation to information and digital media management.

(Digital) Design: Skills and competence required to solve problems creatively and be in charge of complex design processes; recognise and assess the ethical challenges; Produce technically and aesthetically high-quality design work.

(Digital) Communication: Public engagement through the effective use of digital methods and applications; Expanding Roles of Museum Marketing and Communications; use of computer technology in the communication and transmission of culture to specialist and non-specialist audiences.

The DCbox agenda for the customization of an educational offer aiming to train a professional Digital Curator should consider all the above-mentioned multidisciplinary areas, selecting specific topics and subjects, blending them to reach a unique mix of functional expertise, both theoretical and practical.

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Chapter 4: Educational Pathways to qualify as Digital Curator

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