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DIGITAL CURATOR
TRAINING TOOL BOX

ISBN: 9788899586423

Enriching Heritage through Digital Curation

Practice and Training Handbook

EDITORS Ramona Quattrini || Carlos Smaniotto Costa || Catarina Patrício

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ENRICHING HERITAGE THROUGH DIGITAL CURATION: PRACTICE AND TRAINING HANDBOOK

© PUBLICA, Alghero, 2024

ISBN 9788899586423

Pubblicazione Giugno 2024



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**Co-funded by
the European Union**

Disclaimer

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

ACKNOWLEDGMENTS

The partnership of the DCbox project is very grateful to the students and associated partners who decided to be part of this adventure. In particular the partnership acknowledges the following institutions:

Museum of Lourinhã (Portugal)

Municipality of Lourinhã (Portugal)

Museum of Ponisavlje (Republic of Serbia)

Municipality of Fuente Obejuna (Spain)

Civic Gallery of Ascoli Piceno and Ascoli Musei (Italy)

Municipality of Ancona (Italy)

Numana Antiquarium and Marche Regional Directorate for Museums (Italy)

Fondazione Rossini, Pesaro (Italy)

In addition, we would like to thank students and teachers of University of Montenegro and Academy of Fine art in Rome for their commitment in the DCbox MOOC.

The present Handbook constitutes a Deliverable (D5.3) of the DCbox “Digital Curator Training & Tool Box” Project, funded under the Erasmus + programme KA220 in Higher Education - Project number: 2021-1-IT02-KA220-HED-32253

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CHAPTER 1

Introduction

Introduction to the Handbook

Chapter 1.1

Catarina Patrício, Ramona Quattrini

Heritage preservation in the digital age is deeply intertwined with the constitution of a “Global Memory” (Ernst, 2013). The current profusion of databases, along with the convergence operated by the digital transformation, has been leading to a pervasive reformulation of the archival treatment and management, reshaping the institutional borders involved on the curatorial process. Widening the cultural authority that once guaranteed the sovereignty of archive and of archivist to new practitioners (Collins, 1995: 25), digital transformation, that changed the storability, the profusion of data and the transmission of Information in a digital heritage ecosystem, as led to the emergence of the figure of the digital curator.

In addition, the concept of “Cultural Industry” – Adorno and Horkheimer’s critic to the capitalistic system, in which the transformative possibilities of Art greatly reduced in opposition to the disseminated aesthetic objects of mass culture – is gaining a new reconfiguration with the digital. Capitalisation of culture and of cultural institutions, such as museums, and archives, attracted a number of stakeholders for the digital preservation of monuments and archaeological documents. On the other hand, wider structural concerns, at an economic, political and ecological level, have made the conservation and digital reproduction of cultural heritage in a globally accessible archive a pressing issue.

The problem of educability for the digital transition is embedded and stimulated by new mediated environments. From museology to archaeology, digital culture heritage practices



suggest the construction of a participatory archive, permanently open to voluntary collaboration and with free access, dedicated to the cataloguing all objects of the History of Culture, or *anthropofossils* (Patrício, 2021). But there is also an urgent need for the digital treatment of Natural History Documents.

The systematic use of digitalisation, that as promoted a net-like structured society of fixed and mobile terminals (human or non-human entities) seen as “data-providers” presents new opportunities for the aggregation, analysis and correlation between artefacts or documents, representing unprecedented chances for a pedagogical emancipation of individuals in their engaged participation in the process of cultural production and preservation (Patrício et al., 2023).

Nevertheless, museological, curatorial and programming competencies cannot be overlooked, because “for the computer the differences among sound, image, and text, if they counted, would be only the differences among data formats.” (Ernst 2013, 128) Heritage study and research require expertise and competencies. Since digitalised objects “ignores the aesthetic differences between audio and visual data and makes one interface (human ears and eyes) emulate another” (Ernst 2013, 128). Digital memory, therefore, requires a digital curator.

There seems to be a condensation of experience within the digital heritage ecosystem. Indeed, the digital transformation invites us to deepen reflection on the cognitive and creative ecology of the humanities.

This book aims to showcase the major achievements of the project DCbox, that investigated the figure of digital curator, for 30 months. It offers a comprehensive analysis of the current landscape of professional skills in Cultural Heritage, delineating existing needs and emerging trends. Additionally, it outlines the design of the DCbox learning approach for the

Digital Curator skill set, which encompasses various competencies and learning objectives. The book elucidates, from both theoretical and practical perspectives, the implementation of the MOOC titled 'Supporting the Digital Transformation of Museums: The DCbox Approach'. Moreover, it provides insights from proactive learning experiences within the Living Labs, where diverse prototypes of curatorial practices were explored, ranging from virtual reality to storytelling, gamification, and online digital collections. These Living Labs, established in each participating university and beyond, with the involvement of new associated partners, ensure the project's sustainability and underscore the creation of a community. The handbook outlines all these outcomes methodologically, while also offering perspectives from learners and tutors engaged in the framework. In particular, the essay section is devoted to frame the activities of the project in a larger and cross-disciplinary scenario as well as it serves as a thought-provoking exploration into emerging trends and paradigm shifts in the relationship between all the emerging technologies and cultural heritage.

Emerging technologies and digital tools are exerting profound impacts on societal structures, prompting shifts in behaviour, consumption habits, and power dynamics within economic frameworks. Within this evolving scenario, the significance of culture is increasingly noticeable. Over recent decades, the integration of digital technologies into the acquisition and management of Cultural Heritage (CH)-related data has steadily supplanted traditional methodologies of data collection, organisation, and administration. Concurrently, the ongoing digital revolution has permeated the CH sector.

Presently, all cultural places are equipped with digital resources. Activities such as research, online publication, exhibition, outreach, and engagement are commonly facilitated by digital tools, enhancing the efficacy of museum activities and fostering public interaction. Consequently, the formulation of digital strategies has become a compulsory endeavour,

exerting influence across the entire museum ecosystem (Clini and Quattrini, 2021). Moreover, the digital transformation has the potential to catalyse and support museums and cultural institutions in fulfilling their mandates, as articulated by the revised definition of museums by the International Council of Museums (ICOM, 2022). This revised definition underscores museums as agents of transformation, emphasizing their pivotal role in shaping the trajectory of heritage sustainability.

The present handbook represents the result of the project: the role of the digital curator was clarified as situated within the broader framework aimed at equipping museum professionals with adaptive competencies. Emphasising the importance of long-term viability, ethical conduct, and community involvement, this project and similar initiatives seek to enhance the resilience and efficacy of museum practices in an ever-evolving digital landscape. A secondary goal of the DCbox project was to investigate virtual tools in educational practices and various remote learning activities, aiming to develop a pertinent and up-to-date training curriculum for digital curators while also providing a new toolbox for these emerging European professionals. Specifically, the project activities were directed towards addressing the lack in university training programs that are oriented towards the ‘learning by doing’ model within virtual classrooms. This gap of virtual tools able to bridge the theoretical framework provided to students and the essential practical experience required for concept reinforcement was a focal point of the project’s efforts.

The lesson learnt from the project can be summarised as follows. Facing the challenges of the dual imperative of digital and green transformation, the European CH future professional has to reflect a broader ambition to transform museums into sustainable entities, strictly committed in adhering to principles of sustainability. This aspiration transcends the confines of the museum realm and resonates across diverse sectors, be they public, private, or non-profit. The overarching objective of our work was to furnish professionals with the

requisite skills and competencies to navigate these transformative currents, thereby empowering museums not merely to weather the storm of change but to assume a catalytic role in shaping the evolving landscape. While our project alone may not have fully realised this ambition, the collective endeavours of DCbox and analogous initiatives in recent years represent significant strides towards fostering a society better poised to meet the objectives outlined in the UNESCO 2030 Agenda and the European Union's climate goals for 2050.

Executive Summary

Chapter 1.2

Catarina Patrício, Isabel Dantas dos Reis

A Handbook for Transformative Cultural Heritage Practices

At an epoch where digitalisation has become a keystone of cultural preservation and dissemination, the role of the digital curator emerges as a vital profession at the intersection of technology and heritage. The following pages will unfold a comprehensive guide tailored to empower individuals in this dynamic field.

This handbook functions as an encouragement for cultural producers, practitioners, students, and educators alike. It is structured to provide a holistic understanding of the evolving landscape of digital Cultural Heritage and equip readers with the necessary tools to navigate its complexities effectively. Organised into distinct sections, each segment serves a unique purpose in unravelling the multifaceted realm of digital curation.

The Profession of Digital Curator: Unveiling New Domains and Expertise

The journey begins by exploring the genesis of the digital curator profession, shedding light on the emerging domains and requisite skills essential for success in this field. Through insightful discussions, readers will grasp the transformative potential of digital curation in reshaping how we perceive and engage with cultural artefacts.

Central to this achievement was Project DCbox, a collaborative endeavour aimed at nurturing a new generation of European professionals in digital cultural heritage. Delve into the origins of this pivotal project and uncover the stories behind its inception, highlighting the invaluable contributions of our esteemed partners.

Objectives and Outcomes: Paving the Way for Future Challenges

The DCbox project sets forth its objectives and delineates the anticipated outcomes. Readers will gain a profound understanding of how this initiative endeavours to equip museums and cultural institutions with the tools and expertise needed to thrive in an increasingly digital landscape.

Exploring the Handbook: A Roadmap to Success

Navigate the handbook's contents, from the structured Learning Modules (LM) to the innovative pedagogical methodologies designed for remote learning environments. Discover how each chapter facilitates the construction of prototypes and offers practical measures for implementing digital archival treatments.

In our journey towards transforming cultural heritage practices, we extend gratefulness to the students and their prototypes, esteemed partners, and all who have contributed to the realisation of this endeavour.

The handbook outlines the objectives and anticipated outcomes of the DCbox project, aiming to equip museums and cultural institutions with the necessary expertise to thrive in a digital environment. It provides a roadmap for success, guiding readers through learning modules and innovative pedagogical methodologies designed for remote learning.

Further Exploration

As we embark on this transformative journey, we invite readers to research deeper into the potentialities of digital cultural heritage. Explore the references and links provided and embark on a journey of discovery to preserve collective heritage.

Moreover, embark on a technical expedition with this handbook as your guide.

In conclusion, this handbook stands as a beacon for those navigating the intricate terrain of digital cultural heritage. With a blend of insightful discussions, practical tools and structured guidance, it equips individuals with the necessary expertise to thrive in this dynamic field. As we embark on this transformative journey together, let us continue to explore, innovate, and preserve our collective heritage in the digital age.





CHAPTER 2

The DCbox Project

The Story Behind the Project

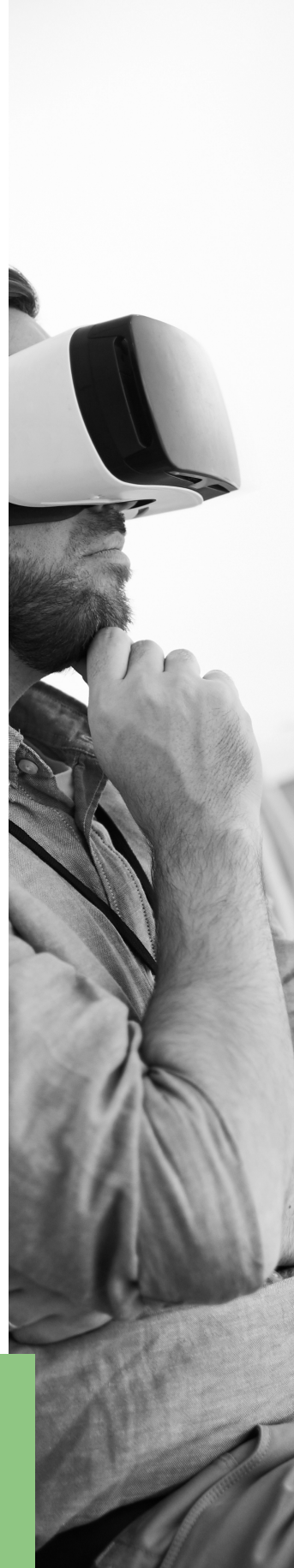
Chapter 2.1

Ramona Quattrini, Massimo Gasparini

New technologies and digital communication are transforming societies, changing lifestyles, consumption patterns and power relationships in economic value chains. In this changing landscape, the role of culture is more important than ever. Over the last decades, the application of digital technologies to the production and management of Cultural Heritage (CH)-related data has progressively been replacing traditional methods of data gathering, organisation and management. In addition, the digital revolution, still in action, has found its way even in the CH sector.

Today, almost all museums and cultural places are accompanied by digital tools. Actions like researching, publishing (online), exhibiting, communicating or participating are likely to be supported by digital tools, which improves the works of museums and strengthen the public exchange. Thus, developing digital strategies has become a cross-sectorial task, which is influencing the whole ecosystem around the museum as a standalone entity.

The opportunities offered by digital solutions for CH are countless; indeed, they do not only make exhibits and artefacts accessible to a wider spectrum of visitors, but they allow to go beyond the physical constraints. Collections can be brought online, creating new environments for exchange and enable participation. Also, to foster the development of Cultural and Creative Industries (CCI), CH should be a facilitator.



tor for local CCI start-up projects and support small creative entrepreneurship in the area of learning, art galleries and workshops, etc.

In this scenario, CCI across Europe are severely affected by the COVID-19 crisis. Cultural institutions for public use/enjoyment, especially museums, have gone from a total closure to reduced access in accordance with social distancing measures. The pandemic had a twofold impact: the impossibility of experiencing the physical dimension of places of CH and the increasing attempts to 'put online' not yet structured cultural products and services. Considering this background, a need emerges to shape, design and professionally encourage the figure of the Digital Curator (DC). This figure represents the turnkey toward real digital transformation because the DC can play an essential role in enabling cultural experiences, knowledge creation, preservation, and use and re-use of cultural heritage across Europe.

The Digital Curator 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, to this date there's no single, unanimously agreed reference framework to empower learners with skills, competences and expertise a DC should provide, that is a synthesis of technical knowhow and humanistic background.

Taking into count this scenario, DCbox "Digital Curator Training & Tool Box" is funded by the Erasmus+ programme of the European Union during the period November 2021 - May 2024 and it works 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 skill-set. More specifically, the project is aimed at:

- better defining the professional figure of 'digital curator', owning digital, marketing and communication skills to engage a broader and more variegated audience;

- 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;
- 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.

The DCbox project intends to overcome difficulties encountered during the first phase of remote learning activities caused by lock-down and build a relevant and up-to-date training curriculum for digital curators providing a new toolbox for these new European professionals.

In particular, the lack of university training activities oriented to the “learning by doing” model in virtual classes, which is a gap between the theoretical approach offered to the student and the essential practical experience to fix concepts.

Partnership

Chapter 2.2

Massimo Gasparini

Consolidating the exploitation of Digital Technologies to promote and valorise CH is paramount, and the cooperation between European countries is fundamental; this requires a base of well-educated experts, who can assess its impacts and create new opportunities.

To reach this goal, DCbox is implemented collaboratively by seven partners from five different Member States (five academic partners specialised in raising awareness and enabling sustainable practices about digital transformation in CH field, a private company focused on ICT innovation and European project management and a network of Universities dealing with the Euro-Mediterranean area):

- Università Politecnica delle Marche (Italy) - coordinator
- Sinergia Consulenze Srl (Italy)
- University of Cordoba (Spain)
- The Cyprus Institute (Cyprus)
- COFAC Cooperativa de Formação e Animação Cultural Crl (Portugal)
- UNIMED – Mediterranean Universities Union (Italy)
- University of NIS (Serbia)

Università Politecnica delle Marche (Italy) is the coordinator of the Project, with an extensive national and international experience in Digital Cultural Heritage, geomatics, drawing and survey of tangible and architectural heritage, development of tools for territorial cultural systems and museums.

The Cyprus Institute (Cyprus) is actively engaged in cultural driven initiatives, in particular exploiting Enabling technologies for Culture and Tourism. Considering its robust abilities and successes in research projects dealing with Digital Heritage, Information and Communication Technologies (ICT), digital documentation and semantics, scientific visualisation and virtual reality methods for art and architecture, it considerably contributes to the objective of innovative learning activities as well as to the quality of IOs.

University of Córdoba (Spain) ensures a complementary and collaborative expertise with the other partners: archaeologists, graphic engineers and geomatics experts, as well as researchers with skills in reconstruction of virtual environments. Given the experiences in implementation of digital techniques to 3D and modelling of Cultural Heritage put at disposal of the partners the knowledge about heritage-based territorial development and a solid humanities expertise.

Universidade Lusófona (Portugal) brings expertise in Architecture, Urban Planning, Arts, Multimedia and Cinema, also ensures robust know-how in Digital Cultural Heritage. It adds profile suited to guide innovative applications in arts, communication and media field, complementing the partnership with creative skills.

University of NIS (Serbia) provides to the project partners its previously developed applications AR/VT/MR and also its consolidated experience in join work with museums and cultural institution that contribute significantly to solve all technical issues as well as to envisage scalability of the projected results during the DCbox project realisation.

UNIMED – Mediterranean Universities Union (Italy) is involved given its robust expertise in Erasmus+ programme in order to facilitate the whole progress of the project, as well as to help in dissemination activities.

Associated Partners

The associated partners are museums and cultural institutions based in all the involved countries of DCbox Project. They are engaged in the experimental-virtual work-based learning experiences, they are stakeholder for the virtual prototypes of DC Box and served as demonstration sites of the

digital transformation of tools and processes. The associated partners also host the traineeships for the Higher Education students.

ITALY

- Civic network museums of Ascoli Piceno
- Civic Gallery “Francesco Podesti” in Ancona

CYPRUS

- Byzantine Museum of Nicosia

SERBIA

- Chamber of Commerce and Industry of Serbia
- Ponisavlje-Pirot Museum

SPAIN

- Municipality of Fuente Obejuna
- Local Action Group of Alto Guadiato

PORTUGAL

- Museu Bordalo Pinheiro
- Museu da Lourinhã
- Centro de Estudos Históricos da Lourinhã
- Geoparque Oeste

During the project implementation, two new Higher Institutions joined the partnership as associated partners:

- University of Montenegro
- Academy of Fine Arts in Rome

Their concrete involvement in the project activities concerned in this case the proposal to their students of the MOOC “Supporting the Digital Transformation of Museums. The DCbox approach” with the possibility to also acquire ECTS in their formal path.

DCbox Objectives and Outcomes

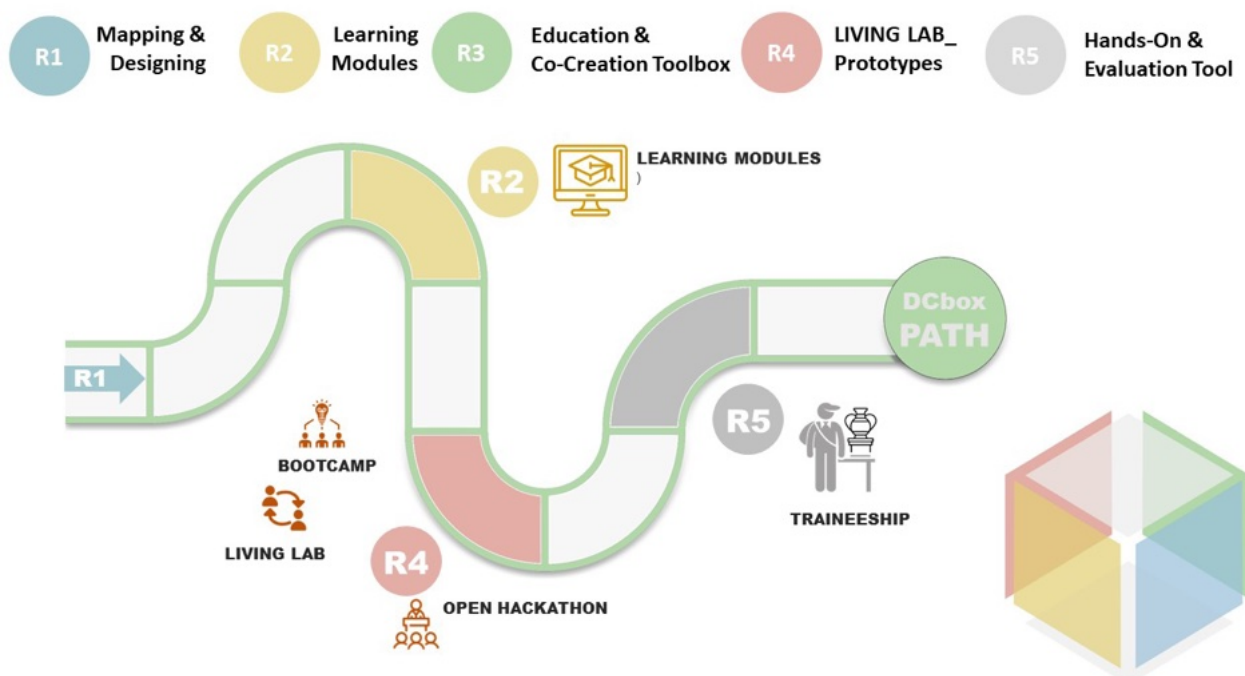
Chapter 2.3

Ramona Quattrini, Chiara Mariotti

At a glance, the main outcomes of DCbox can be summarised as follows:

- A complete analysis of existing learning innovative methods across Europe, focused on digital curatorial skills.
- A tailored training content delivered in a format and interface responding to the needs and specificities of teachers, administrative non-academic staff and students.
- A validated educational toolkit designed for “museum’s Digital Curators”.
- A full “digital accreditation” assessment process for each demonstration site, which can be transferred and adopted by other EU universities, beyond the four European Member States belonging to the partnership.
- A full tailored ‘action plan’ to increase the digital competencies emissions adapted to each of the 5 demonstrative technologies, tailored in different contexts and situations

Fig. 2.1 - The conceptual framework of the DCbox project: the results are linked each other and constitute a whole path for the learners



These summarised outcomes were reached by the consortium through the implementation of the innovative and digital approach, including the DC Toolbox, and attaining the following Project Results (PR).

PR 1	DC Mapping & Designing	A critical mapping and clustering of recognised skillset\regulation state of art across Europe, based on an in-depth analysis and collection of best practices among digital cultural heritage tools and strategies for museums and cultural organizations.
PR 2	Learning Modules	A career-based learning module based on a formal/informal education format (e.g. MOOC, virtual and real time lessons, virtual collaborative rooms etc.) for Digital Curator professionals (DCH curricula).
PR 3	Virtual Education and Co-creation	A virtual space for education, designing, prototyping, rousing creativity and increasing knowledge of students, trainers, mentors and institutions.
PR 4	Virtual Experiences Prototypes	Virtual experiences prototypes co-designed and tested by students through creative living labs focused on 5 different aspects of cultural heritage curation and assessing skills on 5 complementary technologies: Digital Library, Gaming, Immersive experience, Mobile geolocated app and Digital Storytelling.
PR 5	Hands-on and Evaluation Toolbox	A tool-box in which learning outcomes will be tracked and evaluated (via the KPI definition/assessment), also reporting the hands-on experiences carried out during trainees co-tutored by universities and museums.

PR 1 DC MAPPING & DESIGNING

A critical mapping and clustering of recognised skillset\regulation state of art across Europe, based on an in-depth analysis and collection of best practices among digital cultural heritage tools and strategies for museums and cultural organisations. In this perspective, the results obtained in this preliminary phase (Deliverable 1.1, 1.2, 1.3) are preparatory to the definition of the contents of the following learning modules (PR2).

D 1.1 REPORT OF THE HIGHER-EDUCATION PROGRAMS SPECIFICITIES IN EACH COUNTRY

The activity was carried out by all academic partners to design a preliminary analysis in all involved countries and faculties.

D 1.2 ANALYSIS AND COLLECTION OF DCH BEST PRACTICES AND STRATEGIES

The analysis of Digital Cultural Heritage best practices and strategies is carried out at European level and beyond. The most used digital cultural heritage tools for museums and cultural organisations were described, with a primary focus on potential transferability to other contexts. The analysis also took in consideration regulatory framework or address policies of European bodies (Europeana, DG Connect etc.) and national authorities.

D 1.3 DEVELOPMENT OF THE INTERACTIVE GEOREFERENCED IMPLEMENTABLE MAP REGARDING BEST PRACTICES AND STRATEGIES IN DC

This activity had the objective to gather the potential and needed skills considered useful for a successful job placement. Based on the gathered results, the consortium analysed the surveys and their results producing an interactive wiki map identifying how the project contents can be refined to be useful and reach its full efficiency in term of complementary formative formal/non formal paths.

PR 2 LEARNING MODULES

A career-based learning module based on a formal/informal education format (e.g. MOOC, virtual and real time lessons, virtual collaborative rooms etc.) for Digital Curator professionals (DCH curricula). The learning modules give to the students the theoretical background in order to complement their already available skills. This output constitutes the basis on which the following VIRTUAL LABs (PR4) are established.

The on-line course has a general path which presents the application of sustainable strategies for CH and general digital notions in which they lack knowledge/skills/competencies, independently of their starting level.

D 2.1 METHODOLOGY FOR THE LEARNING MODULES AND LAB

This activity identified and designed the methodology that make possible the empowerment of students through a horizontal and collaborative approach and serves the purpose of this activity.

The foreseen learning activities and workshop laboratories also lead to the definition of the conceptual structure and main functionalities of the learning platform (namely DCBox).

D 2.2 DIGITAL CURATION CURRICULUM

The consortium produced the syllabus containing the topics previously identified grouped in modules.

D 2.3 LEARNING MODULES

Basing its activity on the result from Del 2.1 and 2.2, the consortium produced all the teaching materials that cover the topics of the syllabus. Teaching materials production was subdivided as follows:

- Teaching materials on skills with particular focus on cutting edge & sustainable digitisation for CH.
- Teaching materials on storytelling methods, pedagogical & learning tools, marketing & communication skills.

PR 3 VIRTUAL EDUCATION AND CO-CREATION

A virtual space for education, designing, prototyping, rousing creativity and increasing knowledge of students, trainers, mentors and institutions.

D 3.1 DEFINITION OF PLATFORM REQUIREMENT

This activity leads to the definition of the conceptual structure and main functionalities of the learning platform.

The Toolbox conceptual structure and main functionalities will be closely related to students empowering/training methodology set in PR2.

D 3.2 SET UP OF THE VIRTUAL COMMUNITY CHANNEL

Its purpose is to build awareness above a large digital community of partners, stakeholders, schools and all the target audience defined in the dissemination activities.

D 3.3 CO-CREATION CHANNEL

This output hosts the content produced by each University during the training courses, outlined in the Result 4. The purpose of this activity is to introduce the novel digital methods in the test sessions. In the first phase of development, a preliminary phase of data collection will allow to study usability, UX design, UI, etc.

D 3.4 AUGMENTED AND VIRTUAL REALITY MODULE

This output was developed in parallel with the remaining actions, in order to test and validate the AR/VR content creation framework.

PR 4 VIRTUAL EXPERIENCES PROTOTYPES

VE prototypes co-designed and tested by students through creative living labs focused on 5 different aspects of cultural heritage curation and assessing skills on 5 complementary technologies: Digital Library, Gaming, Immersive experience, Mobile geolocated app and Digital Storytelling.

The main aim of this output is to familiarise students with DCH tools by offering them an opportunity of cross disciplinary confrontation, but above all a DCH toolkit for their future profession. PR4 is a key output of the project DCbox and it builds upon PR2 and PR3 Outputs.

D 4.1 LIVING LAB ON DIGITAL LIBRARY

The Digital Library is chosen as prototype considering its adaptability to different use cases and kind of heritage. Usually, the Digital Library is based on a collection of 3D artefacts, scientifically digitised: the artefacts become the access point of all information, data and stories that the Digital Curator designs and carries out. Similar approach enables the digital twin paradigm that is currently well recognised.

D 4.2 LIVING LAB ON GAMING

Gamification, as the application of typically game-like elements to CH activities in order to increase engagement and effectiveness of user experiences, above all for younger, proved to have a leverage effect in virtual and in presence cultural visits. In such use case AR is often used to implement gamified visits, exploiting the game elements to encourage visitors in moving towards specific points of interest or reaching additional contents. Students will manage similar concepts to design and test a prototype.

D 4.3

LIVING LAB ON IMMERSIVE EXPERIENCE: VIRTUAL TOUR & STORYTELLING

Virtual tour is considered the leading prototype for facing the challenges of pandemic scenario, allowing to produce immersive scenes also with low-cost procedures (360° photos & videos). The learning innovation here is foreseen by integration of story-telling techniques as well as to train students with tools able to track interest of users, allowing a behaviour analysis and contents feedback in the prototype.

D 4.4

LIVING LAB ON MOBILE GEOLOCATED APP

The technology of a geolocated app, above all for outdoor heritage and landscape, is very diffused in CH projects mainly for touristic purpose. From the skills point of view, it will enable the students to set up a database, to organise information in order to reach interest of visitors for planning heritage/archaeological tour (virtual or in presence), to customise searching with filters and elaborating customised routes.

D 4.5

LIVING LAB ON DIGITAL STORYTELLING

If the development of digital experience and the development of digital content is essential, there is the need to communicate in the right way the Cultural Heritage in the proper way, to meet the expectation of different publics. The narration of history through digital mediated tools requires expertise in storytelling and in defining appropriate methodologies.

PR 5

HANDS-ON AND EVALUATION TOOLBOX

A tool-box in which learning outcomes will be tracked and evaluated (via the KPI definition/assessment), also reporting the hands-on experiences carried out during trainees co-tutored by universities and museums.

D 5.1

TRAINING & REPORT

Each university is responsible to obtain a sufficient number of hosting institution for the training activities. The Universities will warrant one month of trainer ship for each student involved in the activity. Commitment of museums operators and director will be essential for the hands-on activities to be evaluated. They will also serve as tutor for the activities and draw up the report, together with each student involved.

D 5.2

KPI FOR EVALUATING LEARNING OUTCOMES / LEARNING PERFORMANCES

The literature in education highlights a gap in defining a shared methodology to quantify the benefits gained in terms of learning when using Digital Technologies, and especially in the field of Cultural Heritage. This deliverable represents a good occasion to define KPIs for quantitatively evaluate the results of the learning outcomes, for the students who attended the Learning Modules (PR3) and participated to the Virtual Labs (PR4).

D 5.3

HANDBOOK: THE TRAINING HANDBOOK

The Training Handbook is probably the most important and representative intellectual output of the whole project, because it collects in a single document all the best practices and the essence of the DCbox experience. The training handbook objective is to represent the white paper of Digital Curation from different perspective, and will be designed to meet the expectations of all the stakeholders belonging to the project and beyond.





CHAPTER 3

The Profession Digital Curator

The Digital Curator: an Emerging Profession

Chapter 3.1

Ramona Quattrini

The DCbox project deeply investigated the Digital Curator professional profile and put in practice some relevant learning experiences in order to test and assess its methodology. The Digital Curator (DC) is an emerging professional figure whose relevance has been emphasised with the COVID-19 pandemic and the consequent need to rely on digital, smart and connected cultural offers, especially when referring to museums on-site and online visits. Nevertheless, since the beginning of the DCbox project it was clear that there is no single, unanimously agreed reference framework to empower learners with skills, competencies and expertise a DC should possess, encompassing technical knowhow and a humanistic background. Although the DCbox consortium carried out a huge work in order to clarify the potential skills of a DC, the panorama appears multifaceted, and many areas of work related to CH show overlapping and blurred boundaries. This is further exacerbated by the professional landscape in which there is an endemic shortage of funds and understaffing.

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, followed by a state of the art on the educational qualifications and competencies required for a DC. The present literature review is mainly based on EU policies and addresses documents and recommendations by international institutions recognised within the museums and cultural sector domains.



The Figure of the “Curator” Over Time

Since the Middle-Ages the figure of “curator” was defined as the responsible for private collections of artworks called Wunderkammer. The need was to engage a person with appropriate knowledge and artistic taste, able to classify the objects, however 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. Changes began to unfold in 1855 when the artist Gustave Courbet organised his own exhibition in response to a rejection from the Salon’s jury. This artist/curator figure succeeded, specifically since the early 19th century when it became quite usual for artists to set 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 antiques institutions that didn’t enhance their collections (Balzer, 2014).

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 (O’Neill, 2016).

The figure of curator became, gradually, even more significant and independent for the entire 20th century till the 1990s when it reached its peak (Balzer, 2014). 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 (Fogal, 2020).

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

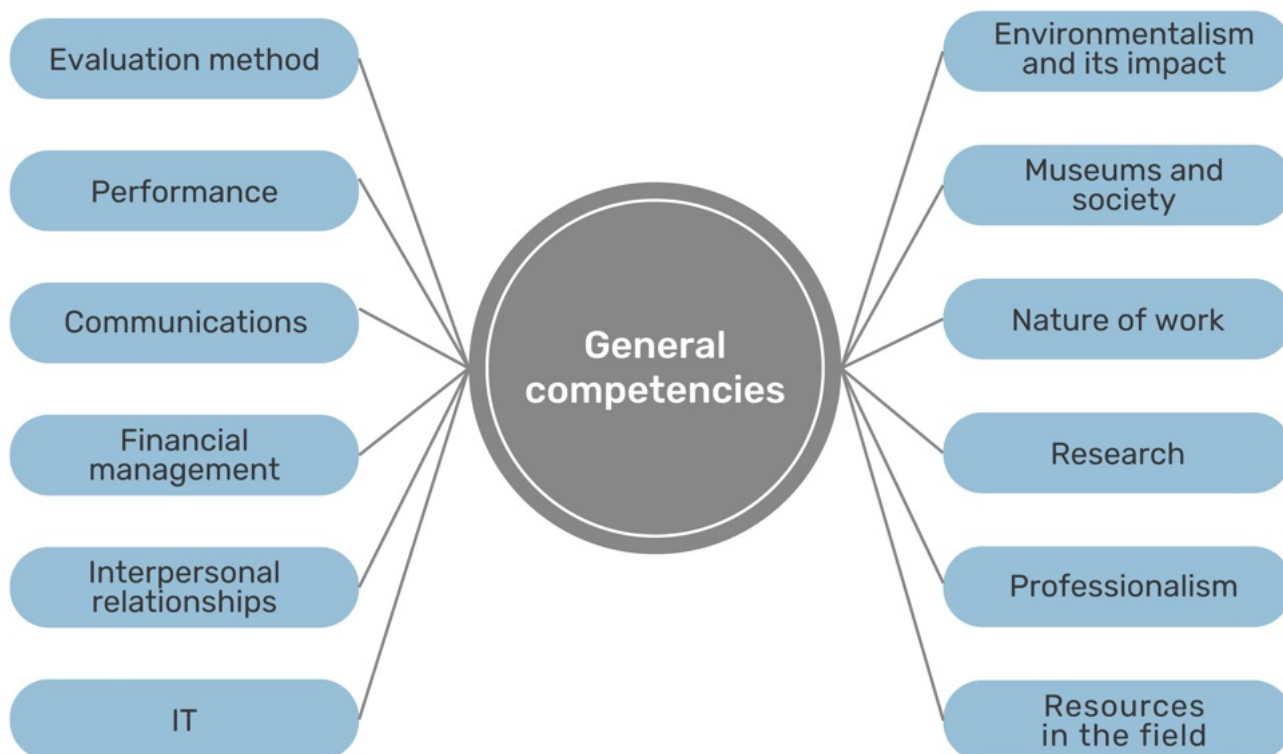
Due to the digital revolution new requirements and new challenges came out. Initially the use of Information and Communication Technologies was regarded as a narrow technical field, the creation, promotion and preservation of digital information came to the fore in the mid-1990s (Hedstrom, 1997). Moreover, another study highlighted the lack of recognised and validated digital competences to be included in digital curation education programmes (Pryor & Donnelly, 2009).

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 (Curricula Guidelines for Museum Professional, 2004) and defined several competencies gathered in five macro-groups:

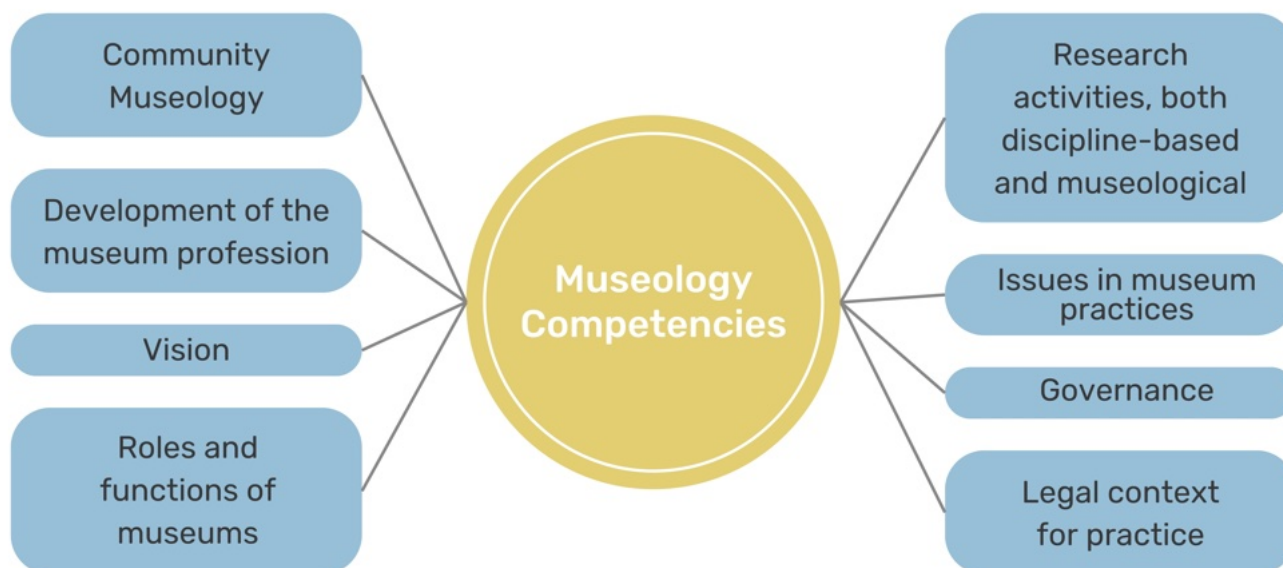
- I. GENERAL COMPETENCIES
- II. MUSEOLOGY COMPETENCIES
- III. MANAGEMENT COMPETENCIES
- IV. PUBLIC PROGRAMMING COMPETENCIES
- V. INFORMATION AND COLLECTIONS MANAGEMENT AND CARE COMPETENCIES

I. GENERAL COMPETENCIES



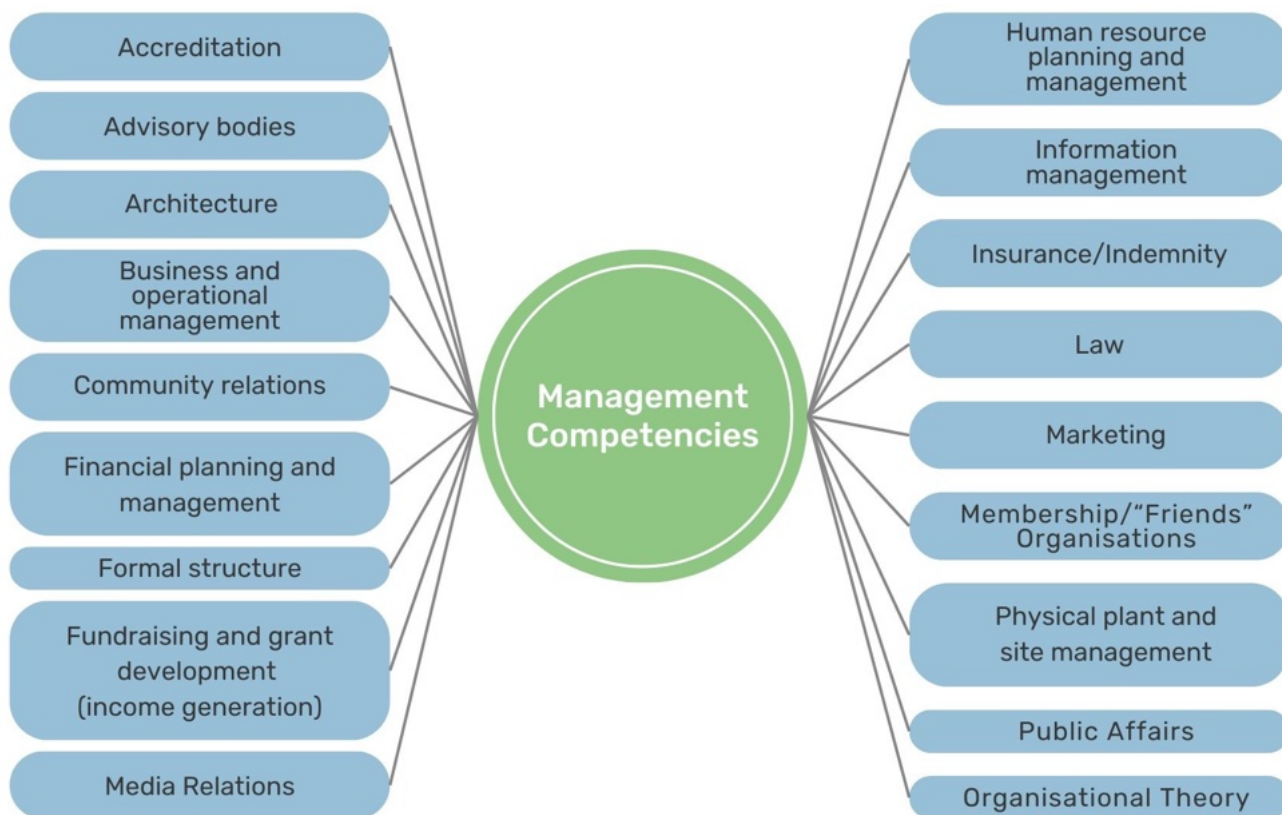
II. MUSEOLOGY COMPETENCIES

Knowledge of and skills in the application of the intellectual foundations of museum work.



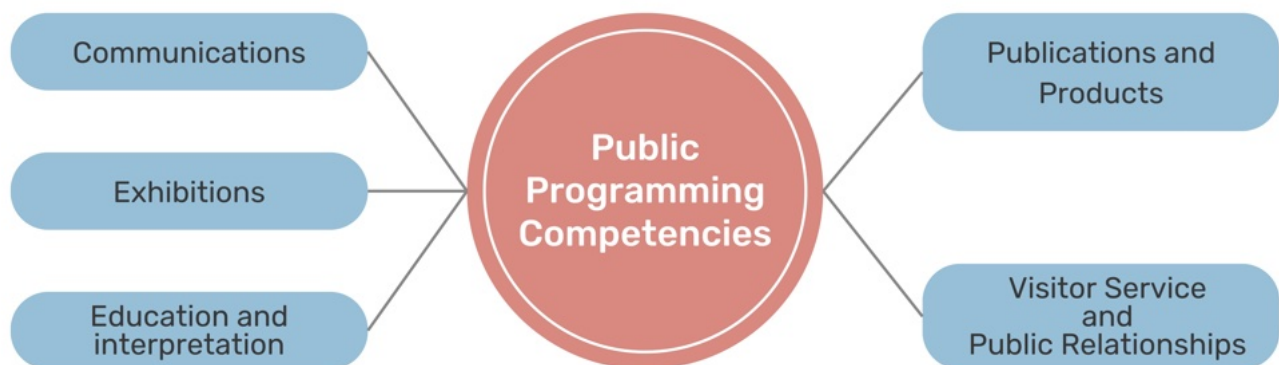
III. MANAGEMENT COMPETENCIES

Knowledge of and skills in the theory and practice of museum operations



IV. PUBLIC PROGRAMMING COMPETENCIES

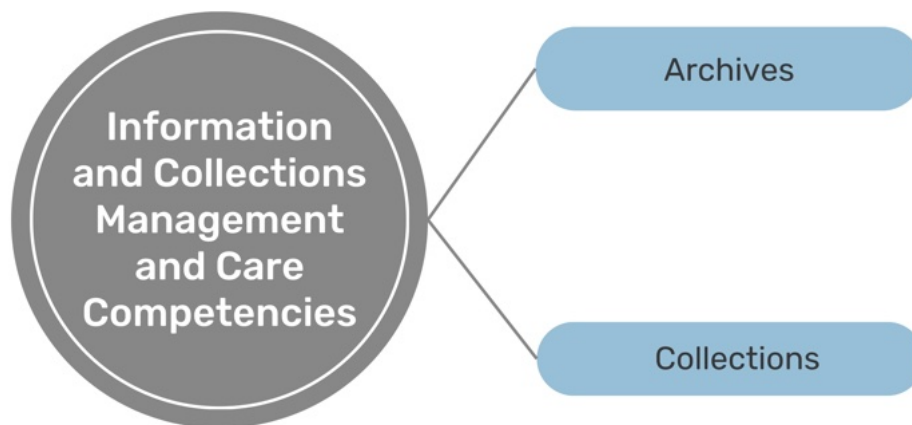
Knowledge of and skills in serving the museum's communities.



V. INFORMATION AND COLLECTIONS MANAGEMENT AND CARE COMPETENCIES

Knowledge of and skills in creating, preserving and sharing museum resources.

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 (European Commission, 2006), 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 (ICTOP, 2008). The objectives were intended to renew the previous 2005 document and to outline new profiles of museum staff, 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 (ICTOP, 2022).

A remarkable step in the EU panorama of open digital collections was the establishment of the web portal Europeana (www.europeana.eu/en), 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 (Europeana, n.d.). It is relevant, here, to summarise the 4 steps foreseen:

1. sensemaking digital transformation
2. defining digital transformation
3. training courses inventorisation
4. developing a capacity building framework

A document that is worth to mention is also the "Strategy for building and implementing a capacity building framework" (Fallon & ter Burg, 2021), which testifies that the Europeana portal is working to create a strategy and implement a frame-

work that empowers, motivates and guides the development of digital capacity building through the cultural heritage sector. The document depicts 3 goals (Empower cultural heritage professionals to drive digital transformation; Motivate cultural heritage professionals to embrace digital transformation; Drive sustainable change) and related objectives (*Fig. 3.1*).

In 2011, the European Commission published the Recommendation on the digitisation and online accessibility of cultural material and digital preservation (European Commission, 2011). 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, the 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.

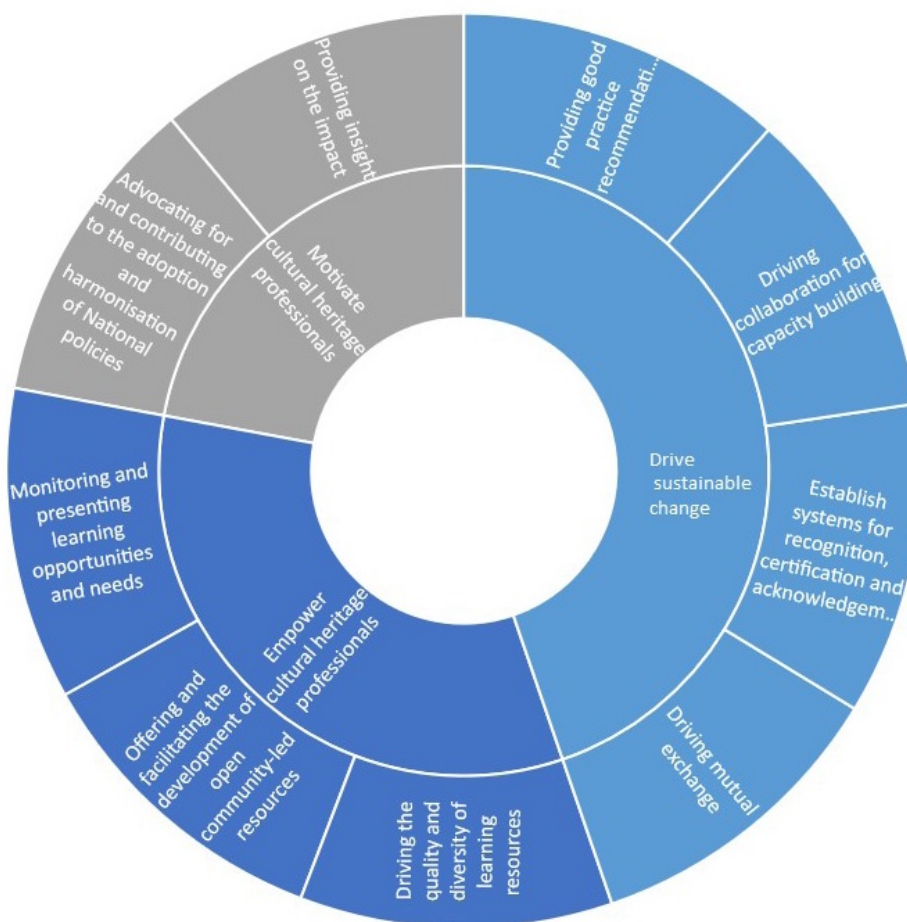


Fig. 3.1 - The 3 goals of Europeana Strategy for building and implementing a capacity building framework, and related objectives (elaboration by the authors)

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) (CEN, 2012) 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, an expert group on “Digital Cultural Heritage (DCH) by the European Commission and Europeana” (European Commission, 2017) was established. Among its several missions, of interest are 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 (Europe's Digital Decade: Digital Targets for 2030, 2021) 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 is pursuing 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.

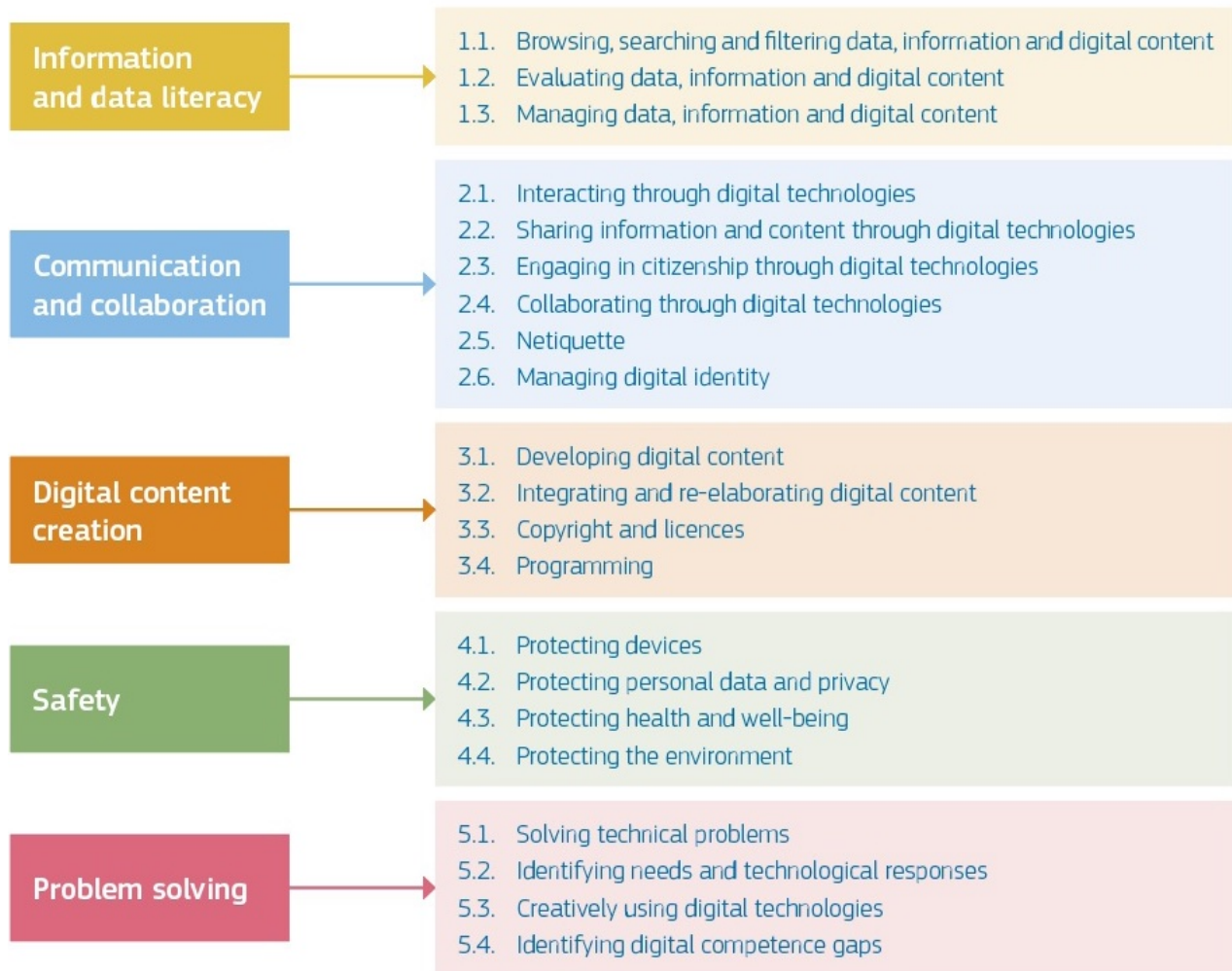
A significant step forward is given by the DigComp 2.2 - The Digital Competence Framework for Citizens: it provides a common understanding of what digital competence is. The publication (Vuorikari et al., 2022) It consists of two main parts: the first provides more than 250 new examples of knowledge, skills and attitudes that help citizens engage confidently, critically and safely with digital technologies, as well as new and emerging ones such as systems driven by artificial intelligence (AI). The second part gives a snapshot of the existing reference material for Dig-Comp consolidating previously released publications and references. The document restates, on the track of previous documents (2006, and after an update of the Council Recommendation in 2018), that digital competence is one key Competences for Lifelong Learning. The competencies are a combination of knowledge, skills and attitudes, in other words, they are composed of concepts and facts (i.e. knowledge), descriptions of skills (e.g. the ability to carry out processes) and attitudes (e.g. a disposition, a mindset to act). Five digital competence areas are outlined: **Information and data literacy; Communication and collaboration; Digital content creation; Safety;** and **Problem solving** (Fig. 3.2).



Fig. 3.2 - The 5 competence areas of DigComp (source DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes)

The first 3 areas deal with competences that can be traced back to specific activities and uses. On the other hand, areas 4 and 5 (Safety and Problem solving) are “transversal” as they apply to any type of activity carried out through digital means. Elements of Problem solving, in particular, are present in all competences, but a specific area was defined to highlight the importance of this aspect for the appropriation of technology and digital practices. The areas are the backbone of the DigComp conceptual reference model (*Fig. 3.3*).

As it should be clear, this framework is not strictly related to people working or acting, in general, on Cultural Heritage, but it is worth mentioning as an umbrella initiative that Increased in importance also given the adhesion of several EU countries, with their national digital agencies (i.e. AGID in Italy). It is possible also to cite Furthermore, other projects could be



cited for able to mapping the digital skills and competencies in Cultural heritage sector. For example, the DASH project, based in the United Kingdom, developed a survey (Dash, 2021): six activities are defined that allow heritage organisations to focus their attention on a small number of questions and consider whether and how they could improve current practice. The framework foresaw: 1. Identify knowledge gaps, such as data protection and copyright 2. Audit the digital skills of members, trustees, staff and volunteers 3. Spot blockers to effective use of digital ways of working 4. Recognise and lock important specialist digital skills into your organisation 5. Find out what digital skills people inside the museum/cultural institution want to improve 6. Evidence improvement (e.g. through time, for funders). The same project also devel-

Fig. 3.3 - The DigComp conceptual reference model (source DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes)

oped “The Digital Culture Compass” (Arts Council of England, n.d.): an online toolkit to support arts, culture and heritage organisations to integrate digital technology into their work. It has two elements: a Charter that outlines digital best practices and a tracker that allows organisations to assess their approach to digital technology and develop plans for future work.

The digital preparedness and upskilling of staff are also at the centre of the Italian PND (National Digitisation Plan), a strategic operational document with which the Ministry of Culture intends to promote and organise the digital transformation process in the five year period 2022 - 2026 (Ministero della Cultura, 2021). The PND’s high level implementation strategy is funded as part of Next Generation EU funding. Its strategy foresees an important effort regarding the pillar of “People” and specific actions are ongoing for capacity building and knowledge transfer (Tab. 3.1).

Tab. 3.1 - The main strategic activities of the Italian National Digitisation Plan, (source <https://charter-alliance.eu/wp-content/uploads/2022/12/PPT1-Mancinelli.pdf>, PND – National Plan for the Digitisation of Cultural Heritage Presentation by Tiziana Mancinelli (Istituto Centrale per la Digitalizzazione del Patrimonio culturale – Ministero della Cultura)

	TECHNOLOGIES	PROCESSES	PEOPLE
STRATEGIC ACTIONS	Cultural heritage data infrastructure	Digitization and life cycle of the digital resource	Capacity building and transfer of knowledge
	Certification system of digital identity of cultural items	Access policy and reuse policy	Cultural dissemination and social sharing
	Enabling technologies for a user-centered design	Design of services and models for value creation	Co-creation and crowdfunding

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 implement-

ed mainly on a local scale. This was also highlighted by the public consultation held between June and September 2020 (DG Connect - Interactive Technologies Digital for Culture & Education Group 2, 2020). For our purpose, it is worth mentioning that when asked about the importance of supporting digital transformation in the cultural heritage sector in the aftermath of the COVID-19 crisis, 81% of respondents 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 recognised that the potential of 3D digitisation 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 (Nemo, 2020), 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 (Nemo, 2021), 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 (Recommendation on a Common European Data Space for Cultural Heritage, 2021), 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 clearly highlight 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 Digital Cultural Heritage 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) (Parthenos Project, n.d.) 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 (About PARTHENOS VRE - D4Science Infrastructure Gateway, n.d.). 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 (Digital Curation Center, n.d.).

Madrid (2013), after several professionals’ evaluations, provided 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."

Robinson et al. (2007) 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 (2011-2014), funded through the European Commission's Leonardo da Vinci Lifelong Learning Programme, delivers a framework to support the development of curricula for the vocational training of digital curators working in cultural heritage (Ross & Moles, 2013). To enhance usability, it is composed by three distinct lenses or views. Each of these lenses corresponds to a different group of staff in curation activities:

Practitioner - focussing on skills, knowledge and competencies required for the planning and execution of specific digital curation tasks.

Manager - focussing on a higher-level understanding of the procedures and components of curation programmes.

Executive - focussing on high level strategy placing em-

phasis on digital curation in the context of the parent organisation's business model and mandate.

The E-cult skills project (2013-2015) (ECult Skills, n.d.) 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) (IL PROGETTO MU.SA – Mu.SA: Museum Sector Alliance, n.d.) aimed to address the increasing disconnection between formal education and training and the world of work. It also aims to better manage the emergence 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 (*Fig.3.4*):

- 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 digitised). In larger museums this could be a role-profile, while in smaller museums a curator should be up skilled in the area (Mu.SA Project, 2019) (Figs. 3.5; 3.6).

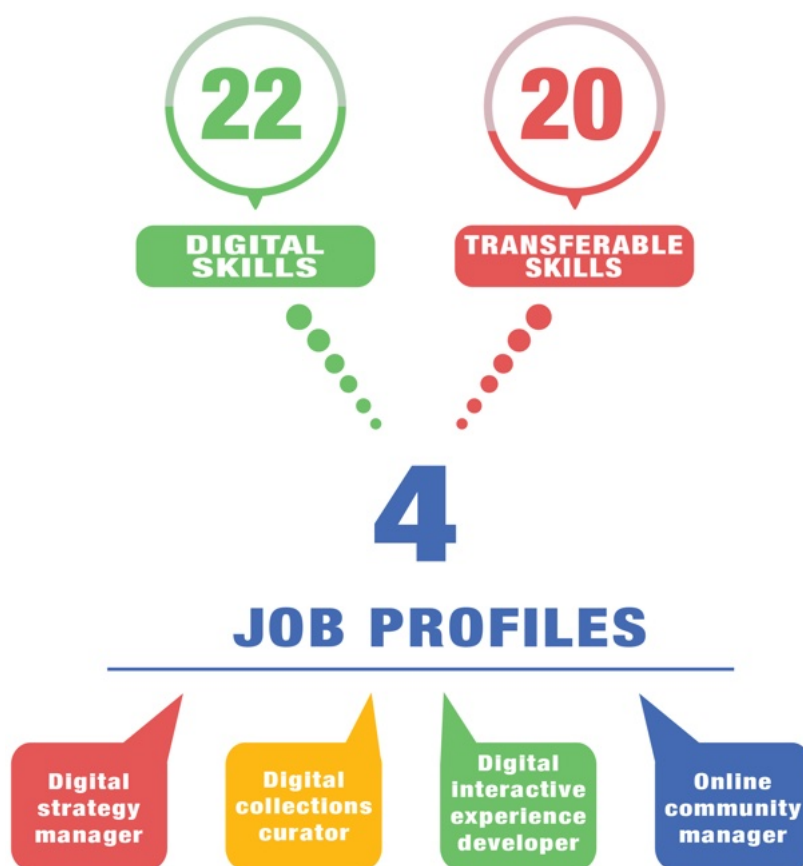
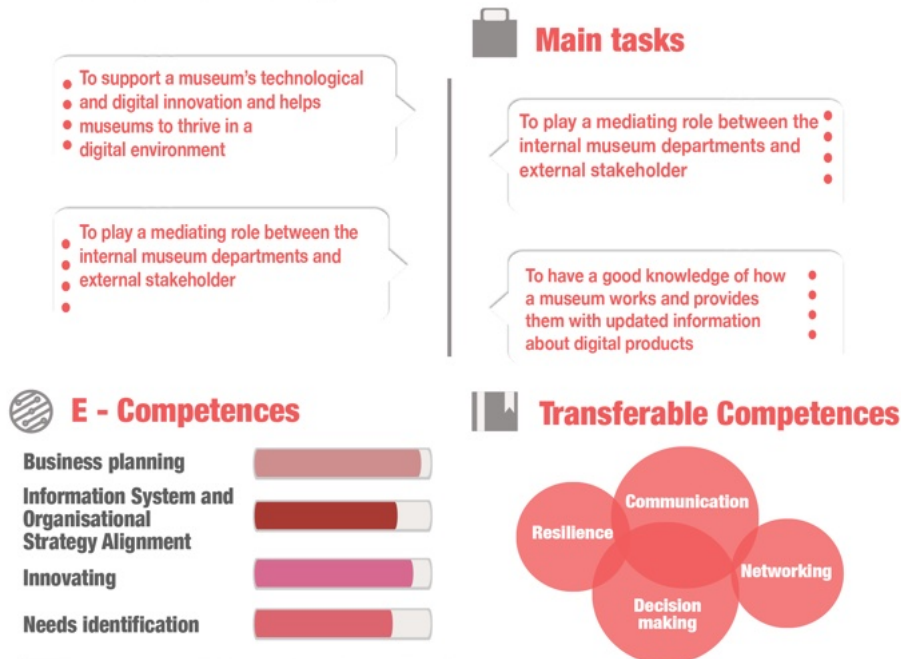


Fig. 3.4 - Most relevant emerging role-profiles defined by Mu.SA project with main tasks, E-competences and transferable competences (source Mu.SA project)

DIGITAL STRATEGY MANAGER ★

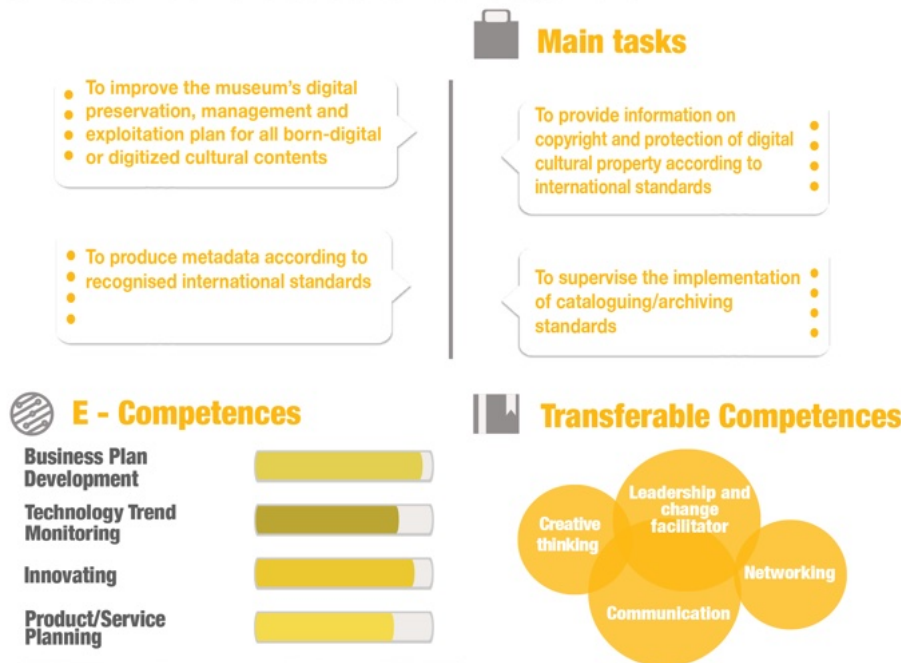
A strategic role for all the museums that aim at thriving in a digital environment in line with the overall museum strategy



★ see full profile in the "Consolidate Report"

DIGITAL COLLECTIONS CURATOR ★

This role is specialised in preserving and managing digital materials. S/he develops online and offline exhibitions and content for other departments



★ see full profile in the "Consolidate Report"

Fig. 3.5 - Most relevant emerging role-profiles defined by Mu.SA project with main tasks, E-competences and transferable competences (source Mu.SA project)

DIGITAL INTERACTIVE EXPERIENCE DEVELOPER★

This role is specialised in designing, developing and implementing innovative and interactive experiences for all types of visitors



Main tasks

- To designs and prototype interactive and innovative installations
- providing meaningful experiences for all types of audiences

- To carry out audience research and observation analysis

- To facilitates communication flow between museum teams and external high tech companies

- To develop accessibility tools for all types of visitors



E - Competences



★ see full profile in the "Consolidate Report"



Transferable Competences



ONLINE COMMUNITY MANAGER★

This role profile is vital for all museums aiming to invest in developing and engaging diverse audiences online and should be fully integrated into the institutional structure



Main tasks

- To design and implement an online audience development plan in line with the museum's overall strategic communication plan

- To engage, monitor and to manage online audiences

- To liaise effectively with the other departments within the organisation in order to produce both content and meaningful online experiences

- To assess and evaluate the effectiveness and efficiency of online activities



E - Competences



★ see full profile in the "Consolidate Report"



Transferable Competences



Fig. 3.6 - Most relevant emerging role-profiles defined by Mu.SA project with main tasks, E-competences and transferable competences (source Mu.SA project)

The Erasmus+ funded project CHARTER (Cultural Heritage Actions to Refine Training, Education and Roles) 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.

Regarding the first objective, a significant effort was made in studying several national and international classifications for skills and competences qualifications and occupations (ISCO International Standard of Occupations - and ESCO European Skills Competences and Occupations), trying to give a harmonisation to the “landscape of heritage”. The project released a set of fact-sheets relevant for mapping the cultural heritage professional skills and identifying then the gaps, in particular here it should be referred to the D.2.2 Families of competences¹ and to the D.2.3. Matrix and methodology assessment².

CHARTER identified 6 Functions (*Tab. 3.2*), considering that professional activities and processes emerge in response to

¹ https://charter-alliance.eu/wp-content/uploads/2022/07/D2.2-Factsheets-Families_of_competences_FINAL.pdf

² https://charter-alliance.eu/wp-content/uploads/2023/04/D2.3-Mid-term-results-Matrix_and_methodology-assessment_FINAL.pdf

this view of heritage. These can be clustered across a range of core functions which come to describe the heritage sector, and can be mapped according to individual competences.

Recognition	Preservation & Safeguarding	Engagement & Use
Refers to all the activities necessary to identify and recognise cultural heritage through, identification and advocacy.	Refers to the activities that need to be put into place to ensure the long term survival and care of cultural heritage, from maintenance to conservation, preventive conservation, restoration, and safeguarding of intangible cultural heritage	Refer to all activities necessary to access and open cultural heritage, make it understandable, make it available for consultation and use, raise awareness, etc. and its use as a resource by all stakeholders. Includes activities that add value beyond the action itself as it impacts society.
Research & Development / Education	Management	Governance & Policy Making
Refers to all the activities that are necessary throughout the process that go from the recognition of cultural heritage to the preservation and enhancement of cultural heritage.	Refers to all activities that go from strategic planning to everyday administration and management: it includes organisational development, human resources management, funding, legal aspects, marketing and communication, risk management and quality control.	Refers to the decision-making for cultural heritage in the wider domain of cultural heritage policy at local, regional, national and international level.

Table 3.2 - The six functional areas of heritage professions according to the CHARTER project (source CHARTER project)

An interesting feature of this classification is that, considering the eco-systemic nature of the heritage sector, Functions can cross-pollinate and behave in a non-hierarchical manner, and activities clustered within the Functions are discrete and integral to the heritage sector (Fig. 3.7).

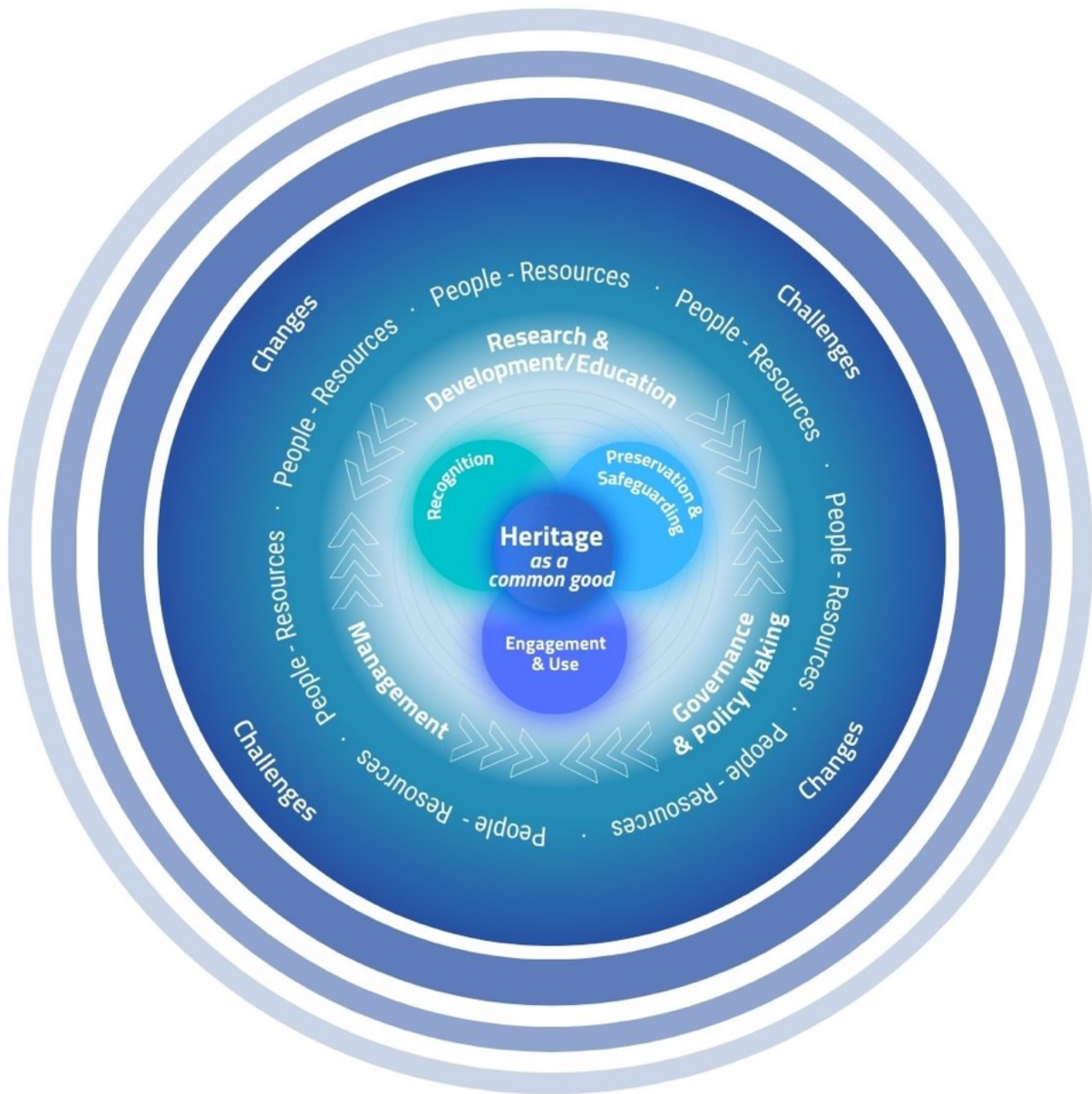


Fig. 3.7 - The CHARTER Model (source CHARTER project)

A table is also provided organising tasks of the CH sector, ESCO skills and ICOMOS. By merging the 6 Functions and the ESCO pyramid that organises competences in a hierarchy of increasing sectoral specificity, the project was able to release the Spider CHARTER tool. The Spiderweb (Fig. 3.8) is a graphic of heuristic learning and competence, where competence is understood as the ability of a professional to do their job vis-à-vis a group of discrete tasks and activities. From the centre outwards, the 8 bandwidths represent increasing complexities of knowledge and skill (CHARTER project, 2023 a).

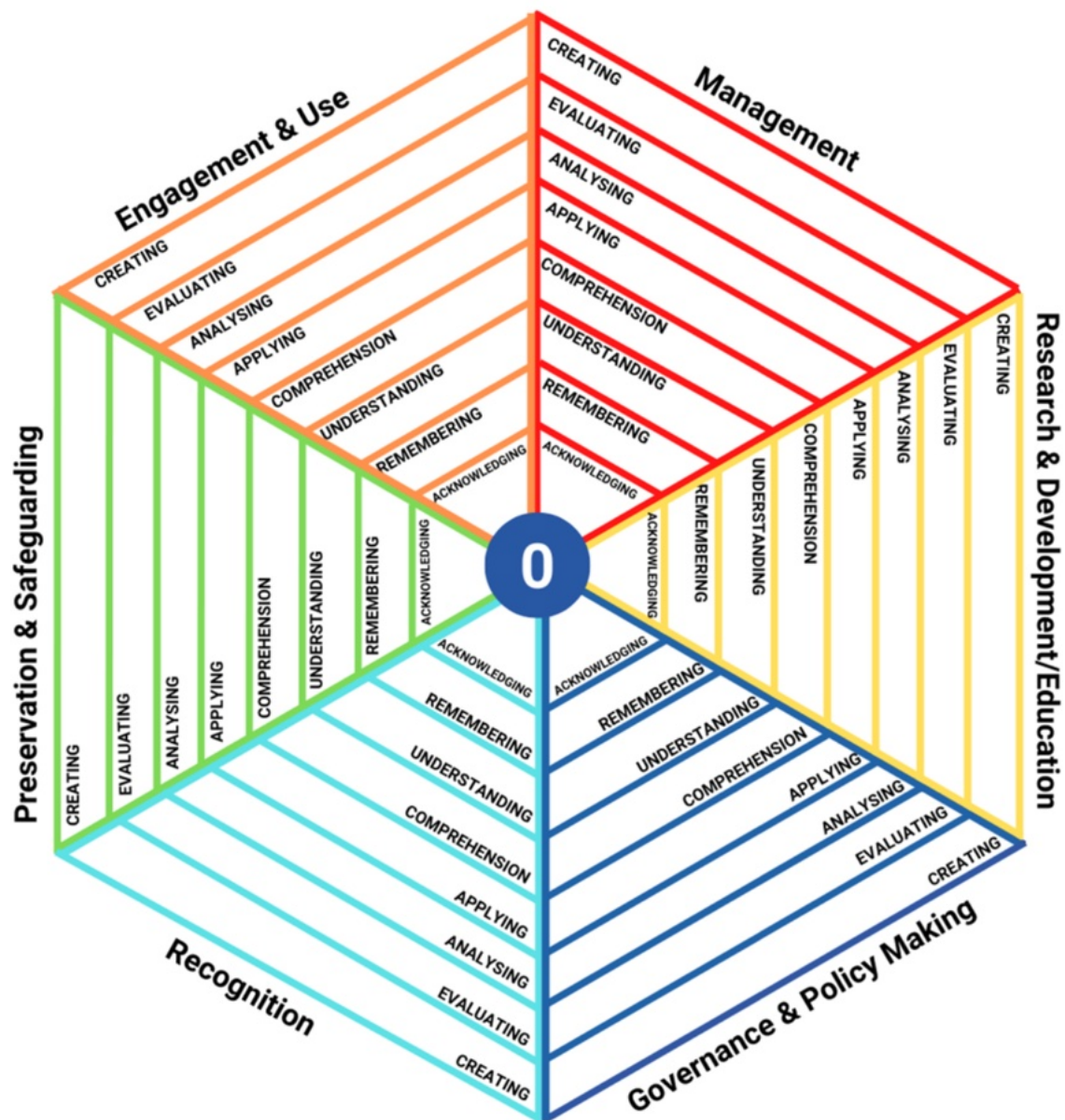


Fig. 3.8 - The spiderweb tool: note that here, the pyramid has merely been inverted in order that the footprint of knowledge is seen to expand progressively outwards rather than narrowing inwards (source CHARTER project)

Due to the massive availability of digital records and databases, an interesting outlook is foreseen by the Spice Project that investigates the possibility to change the paradigm from an authoritative approach to a citizen curation approach. The general aim of the citizen curation is not to just provide multiple interpretations so that the citizen can select the one that fits with their World view, but rather to promote dialogue across perspectives, according to the spirit of the Faro convention (Daga et al., 2022). It defines Citizen Curation as citizens applying curatorial methods to archival materials available in heritage and memory institutions as well as to items depicted in exhibitions in order to develop their own interpretations, share their own perspective and appreciate the perspectives of others. Crucially, our definition of Citizen Curation covers both citizens sharing their own perspectives and also engaging positively with the interpretations of others. This is just an example about the complex scenario in which the digital transformation continues to trigger changes and increase opportunities as well as asks for different sights and competences.

In conclusion, although the urgency of capacity building persists, integrating humanistic and technological perspectives is essential. This approach not only addresses tools and computational resources but also attends to human capital. Despite this urgency, there are notable achievements and action lines evident in the current landscape. Being a multifaceted profession, a Digital Curator must possess the ability to design, execute, and promote a digital strategy for the documentation, conservation, enhancement, and presentation of cultural contents. Consequently, they should take a leading role in the entire digitisation and digitalisation processes, leveraging a combination of ICT, managerial, and humanities skills and competences. Taking into account the expertise of the partners and the pressing needs of the market, the DC-box decided to concentrate on a professional profile closely related to the Digital Interactive Experience Developer, in alignment with the Mu.SA clustering. However, due to chal-

allenges in securing a diverse array of dedicated 'digital' staff in smaller to medium-sized museums, the approach also addressed further skills and roles, including the digital strategy manager and, to a limited extent, the proper digital curator. It is strongly testified by the learning outcomes and competences provided by the MOOC, as synthesised in the [*section 4.2 of the present handbook*](#).

Regarding the CHARTER functions, the skills that DCbox primarily addresses are related to the 'Engagement & Use' function. However, establishing the positioning within the Spider diagram of the expected outcomes of DCbox is challenging. This difficulty arises due to the participants in the project being involved in various learning activities, with levels of engagement and commitment varying considerably. An important confirmation in the learning approach by the DCbox come from a CHARTER deliverable published after the Syllabus design and the implementation of our MOOC. In fact, the list of competences foreseen by the CHARTER project(2023b) and related to the emerging heritage pathway named "Cultural heritage in the digital environment" matches perfectly with the Dcbox learning outcomes.

Digital Curator – Requirements for a Professional Profile & the DCbox Training Programme

Chapter 3.2

Bata Vasic, Carlos Smaniotto Costa

In the rapidly evolving landscape of cultural heritage management, the role of a Digital Curator in Europe has emerged as a linchpin for the preservation and promotion of diverse

cultural artefacts in the digital realm. A Digital curator acts as stewards of our digital heritage, orchestrating the curation, management, and accessibility of invaluable cultural resources. A Digital curator plays a pivotal role in shaping the narrative of our cultural heritage in the digital age. Through formal education and ongoing professional development, they contribute to the preservation, understanding, and appreciation of diverse cultural resources, ensuring their accessibility for generations to come.

In the pursuit of the goals, DCbox defined the profile of a Digital Curator, as a new profession emerging out of the digital and mobile advancements. Through DCbox, during the Digital Curator programme, the apprentice will learn specific key qualifications to improve and enrich the cultural sector.

DCbox defines the Digital Curator as the professional who going beyond the merely data curation, is equipped with creative, cross-cutting and high-level digital skillset, along with marketing and communication skills, is able to develop high quality digital contents and virtual visits - these with more immersive and interactive features.

The world is in the midst of a digital transformation. The digital and mobile advancements are driving innovation and new opportunities. This, associated with the digitalisation of cultural heritage is opening new opportunities and challenging the cultural sector. An unprecedented expansion of the digital calls for professionals with skills and knowledge to create, enrich and maintain content and services over the long-term, assuming stewardship of digital assets with a social mission - safeguarding and communicating heritage. Taking forward the social development combined with advances in technology is in line with the Europe's Digital Decade: digital targets for 2030 (European Commission, 2020a). This also regarding the digital rights and principles set by the EC.

Regulation of the Digital Curator Professional

There is no specific law or legislation that regulates 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 states that the protection of cultural heritage falls upon each state/country to ensure effective and active measures and policies (European Commission, 2014a). 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.

Regarding digital curation in museums, many public and private museums have advanced their digital presence through projects with consultants such as marketing companies or other technological institutions. For example, the Ministry of Communications and Works in Cyprus, through the Department of Electronic Communications, issued in 2012 a 'Digital Strategy for Cyprus' (European Commission, 2014b) 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.

In the dynamic landscape of cultural heritage and information management, the role of a digital curator has become increasingly vital. Digital curators play a crucial role in preserving, managing, and making accessible digital content, ensuring the longevity and relevance of cultural artefacts and information in the digital age. The responsibilities of a digital curator encompass not only the curation of digital collections but also the implementation of innovative technologies to enhance the accessibility and engagement of cultural heritage resources.

In Europe, digital curators are often found working in muse-

ums, libraries, archives, and other cultural institutions. Their tasks include selecting, appraising, and managing digital materials, as well as developing strategies for long-term preservation. Furthermore, they contribute to the design and implementation of digital exhibitions, collaborate with partners to promote cultural heritage, and stay abreast of technological advancements to adapt their practices accordingly.

The digital curator professional in Europe requires a multidisciplinary skill set, combining expertise in information management, archival practices, digital preservation, and technology integration. Strong communication skills are also crucial, as digital curators often collaborate with diverse stakeholders, including researchers, educators, and the wider public.

Growing Importance

The role of digital curators in Europe has been gaining prominence due to the increasing digitisation of cultural heritage materials and the need for effective digital preservation and access strategies. The growing importance of the digital curator profession in Europe is reflective of broader trends in the management and preservation of cultural heritage in the digital age. Here are some additional insights into why the role has been gaining significance:

■ Increasing Digitisation Efforts

As cultural institutions across Europe accelerate their digitisation efforts, there is a growing volume of digital assets to manage, curate, and preserve. Digital curators play a pivotal role in navigating this transition from physical to digital formats.

■ DIGITAL PRESERVATION IMPERATIVES

The digital curator's role is crucial in addressing the challenges of digital preservation. With the rapid evolution of technology, there is a pressing need to develop strategies

that ensure the long-term accessibility and integrity of digital collections.

■ EXPANDING DIGITAL COLLECTIONS

The expansion of digital collections in museums, libraries, and archives necessitates specialized skills in managing diverse types of digital materials. Digital curators are tasked with organising, cataloguing, and providing access to an ever-growing array of digital artifacts.

■ USER EXPECTATIONS AND ACCESS

There is a heightened expectation for increased accessibility to cultural heritage resources. Digital curators work to make digital collections more user-friendly, ensuring that the public, researchers, and educators can easily discover and engage with cultural materials online.

■ TECHNOLOGICAL ADVANCEMENTS

The integration of cutting-edge technologies such as artificial intelligence, machine learning, and augmented reality into the curation process has heightened the demand for professionals who can navigate and leverage these innovations effectively.

■ CULTURAL HERITAGE INNOVATION

Digital curators are at the forefront of cultural heritage innovation. They contribute to the development of new digital tools, platforms, and strategies that enhance the presentation and interpretation of cultural artifacts in ways that were not possible with traditional methods.

■ GLOBAL COLLABORATION

With the interconnected nature of cultural heritage, digital curators often engage in global collaboration. The

importance of sharing digital collections and expertise across borders has increased, contributing to a more interconnected and accessible cultural heritage landscape.

■ EDUCATIONAL AND RESEARCH IMPACT

Digital curators contribute significantly to the educational and research impact of cultural institutions. They facilitate access to digital collections for academic researchers, educators, and students, fostering a deeper understanding and appreciation of cultural heritage.

■ RESPONSIVE TO SOCIETAL CHANGES

The digital curator role is responsive to societal changes and trends. For example, the increased focus on inclusivity, diversity, and community engagement is reflected in the way digital curators approach the curation and presentation of cultural heritage.

■ PRESERVATION OF INTANGIBLE HERITAGE

Beyond tangible artifacts, digital curators are involved in the preservation of intangible heritage, including digital art, born-digital materials, and cultural expressions that exist in digital formats.

In summary, the growing importance of the digital curator profession in Europe is driven by the need to navigate the challenges and opportunities presented by the digital transformation of cultural heritage. It's a dynamic field that requires professionals who can adapt to technological advancements, collaborate across disciplines, and contribute to the preservation and accessibility of diverse cultural resources.

INTERDISCIPLINARY NATURE OF DIGITAL CURATION

Digital curators in Europe often possess interdisciplinary skills, combining expertise in archival science, information

management, cultural heritage studies, and technology. These multidisciplinary skills are crucial for addressing the diverse challenges in managing digital collections. The interdisciplinary nature of the digital curator’s role in Europe reflects the need for professionals who can integrate knowledge and skills from various fields to effectively manage, preserve, and present digital cultural heritage.

Table 3.3 - Deeper exploration of the interdisciplinary nature of the digital curator

	ROLE	IMPORTANCE
ARCHIVAL SCIENCE	Draw on principles of archival science to establish best practices for the appraisal, arrangement, description, and preservation of digital materials	Ensures that digital collections adhere to archival standards, facilitating systematic organisation and long-term access
INFORMATION SCIENCE	Apply information science concepts to organise, categorise, and provide meaningful access to digital collections through metadata creation and information retrieval strategies	Enhances the discoverability and usability of digital assets, contributing to effective information management
CULTURAL HERITAGE STUDIES	Utilise insights from cultural heritage studies to contextualise digital artifacts within cultural, historical, and social frameworks	Enables a nuanced understanding of the cultural significance of digital assets, informing curation and presentation decisions
TECHNOLOGY INTEGRATION	Embrace technological advancements and integrate them into digital curation practices, leveraging tools such as digital asset management systems, preservation software, and emerging technologies like AI and VR	Ensures that the digital curator remains adept at utilising the latest technologies to enhance digital collections

DIGITAL HUMANITIES	Collaborate with digital humanities scholars and researchers to integrate computational methods and analytical approaches into the curation and interpretation of digital artefacts	Enhances the scholarly and research-oriented aspects of digital curation, fostering deeper insights into cultural assets
MUSEUM AND COLLECTION MANAGEMENT	Apply principles of museum and collection management to develop strategies for acquiring, cataloguing, and exhibiting digital collections	Aligns digital curation practices with established (museum) standards, ensuring professionalism in the management of digital cultural heritage
LIBRARY SCIENCE	Utilise library science concepts for the organisation, preservation, and accessibility of digital resources, particularly in digital libraries and online repositories	Leverages library science principles to enhance the cataloguing and accessibility of digital materials for diverse user groups
COMMUNICATION AND OUTREACH	Apply communication skills to engage with diverse stakeholders, including researchers, educators, the general public, and industry professionals, to promote digital cultural heritage	Facilitates collaboration, public engagement, and the dissemination of cultural heritage knowledge
LEGAL AND ETHICAL CONSIDERATIONS	Navigate legal and ethical considerations related to copyright, intellectual property, and ethical practices in digital curation	Ensures compliance with legal standards while preserving and providing access to digital collections
USER EXPERIENCE DESIGN	Integrate principles of user experience (UX) design to enhance the accessibility and usability of digital collections, ensuring positive interactions with cultural heritage resources	Prioritises the needs and expectations of users, contributing to a more inclusive and engaging digital experience

The interdisciplinary nature of the digital curator's role in Europe underscores the importance of a well-rounded skill set that draws from multiple fields. This approach enables digital curators to navigate the complexities of managing diverse digital collections within the broader context of cultural heritage.

Other aspects, recognised as very important in Europe can be divided on:

■ TECHNOLOGY INTEGRATION

Digital curators are actively integrating emerging technologies into their practices. This includes the use of artificial intelligence, machine learning, virtual reality, and augmented reality to enhance the curation, preservation, and presentation of digital artefacts.

■ COLLABORATION AND PARTNERSHIPS

Collaboration remains a key aspect of the digital curator's role. European digital curators often collaborate with researchers, educators, industry professionals, and international institutions to promote cultural heritage through digital means.

■ EDUCATION AND TRAINING PROGRAMS

Educational institutions in Europe offer formal training programs, including master's degrees and courses, focused on digital curation. These programs aim to equip professionals with the skills needed for effective digital collection management and preservation.

■ DIGITAL CULTURAL HERITAGE INITIATIVES

Europe is actively involved in various digital cultural heritage initiatives. Organizations such as Europeana play a significant role in aggregating and providing access to digital collections from cultural institutions across the continent.

■ LEGAL AND ETHICAL CONSIDERATIONS

Digital curators in Europe navigate legal and ethical considerations related to copyright, intellectual property rights, and ethical practices in digital curation. Compliance with these standards is crucial in managing and providing access to digital collections.

■ OPEN ACCESS AND USER ENGAGEMENT

There is a growing emphasis on open access principles, making digital collections more accessible to the public. Digital curators are increasingly focused on enhancing user engagement through social media, online exhibitions, and interactive experiences.

■ CONTINUOUS PROFESSIONAL DEVELOPMENT

Given the rapidly evolving nature of technology, digital curators in Europe prioritize continuous professional development. This includes staying informed about new tools, best practices, and participating in relevant workshops and conferences.

■ CHALLENGES AND OPPORTUNITIES

Digital curators face challenges such as ensuring the long-term preservation of digital assets, addressing issues of digital obsolescence, and balancing open access with copyright considerations. However, these challenges also present opportunities for innovation and improvement in digital curation practices.

These are the premises for the educational programme developed by DCbox . In order to open to the apprentices a broader and more variegated job opportunities, both disciplinary and interdisciplinary knowledge are vital and necessary aspects in the formation. This sets DCbox at the forefront of the generation of knowledge and skills. Regarding disciplinary features of a Digital Curator, DCbox recognises five main

strands, which are interwoven and interdependent - digital humanities, digital museology, digitisation and VR, digital communication, digital design, and digital management. Backed by these knowledge, a Digital Curator have technical and operational capacities, is able to interpret the information and build contents and transfer (communicate) these in the digital environment.

If you are interested on how the Digital Curator's role developed over time, check the Lesson 1.4 by Prof. Carlos Márquez Moreno, University of Córdoba (Consult the MOOC: Supporting the Digital Transformation of Museums The DCbox approach --><https://moodle.dcbox.eu/>)

Another aspect of the rapid spread of digital technologies refers to the support for Online Learning. DCbox taking this opportunity also deals with distance learning tools for higher education. In this way, the DCbox training programme enables apprentices to learn from anywhere and on own schedule, in a self-direct learning. The programme is flexible and lectures, readings and other learning materials can be accessed at any time. The distance learning help promote lifelong learning opportunities.

The Digital Competence according to the EC (2018) refers general to citizens but these are also relevant for a digital curator, who from the one side, must master digital competences, which involves the "confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It is defined as a combination of knowledge, skills and attitudes."

Also ESCO (European Skills, Competences, Qualifications and Occupations), which identifies and classifies professional occupations and skills relevant for the labour market, and education and training, lists these skills needed for a digital curation:

-
- information and data literacy
 - communication and collaboration
 - digital content creation (including programming)
 - safety (including digital well-being and competences related to cybersecurity).

Thus, the digital competence involves the confident, critical and responsible use and engagement with digital technologies and sharing the results with the society.

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 process, based on the combination of ICT, managerial and Humanities skills and competencies.

Key Responsibilities

Once there is no international law that regulates the profession of digital curator, there is also no directives for exercising the profession. To overcome this shortcoming, DCbox followed recommendations by international and European institutions, such as Curricula Guidelines for museum professional development (2004), Recommendation on the digitisation and online accessibility of cultural material and digital preservation (2006), Museum Professions - A European Frame of Reference (2008) and Europe's Digital Decade: digital targets for 2030 (2020). These provided guidance for establishing the programmed training. However, as described above DCbox understands the profession of a Digital curation to be much more complex than merely described as the management and preservation of digital data/information. Despite this general understanding, DCbox targeted and centred the efforts on a professional carrier that working for the cultural sector or in the field of Digital Cultural Heritage can take the stake and

enrich the curation with a new set of competencies. For DCbox, the wide range of skills and competencies, sets the digital curator as an important link to drive the digital transformation, as a digital curator can be in the forefront of creating a digital dimension in museums and other cultural institutions and disseminating their assets.

A digital curator is thus tasked in Europe with a multifaceted role that goes beyond traditional archival practices. The digital curator navigates the intersection of technology and culture, employing cutting-edge methodologies to safeguard and showcase digital assets.

Table 3.4 - Key responsibilities of the digital curator:

Collaboration	Technology Integration	Digital Collection Management
Engaging with diverse stakeholders, from researchers to the general public, to promote cultural heritage through digital means.	Implementing innovative technologies to enhance the discoverability and accessibility of digital collections.	Selecting, acquiring, and organising digital materials with a focus on preserving cultural integrity.

DIGITAL COLLECTION MANAGEMENT

Digital collection management is a critical aspect of a Digital Curator’s role, encompassing the strategic orchestration of digital assets to preserve, organise, and provide access to cultural heritage in the digital realm. This multifaceted responsibility involves a meticulous and thoughtful approach to curating diverse materials, ranging from historical documents to multimedia artifacts. Digital collection management, as a core component of a Digital Curator’s responsibilities, demands a strategic blend of archival principles, technological proficiency, and a keen understanding of the cultural context. By navigating the intricate process of managing digital collections, digital curators play a pivotal role in preserving, presenting, and perpetuating the rich tapestry of our cultural heritage in the digital age.

	OBJECTIVE	PROCESS
1 SELECTION AND ACQUISITION	Identify and choose digital materials that align with the institution's mission and contribute to the preservation of cultural heritage	Evaluate potential acquisitions based on historical, cultural, and educational significance. Consideration is given to the institution's collection development policy and strategic goal
2 CATALOGING AND METADATA STANDARDS	Organise digital assets for efficient retrieval and management, ensuring they are described comprehensively	Utilise standardized metadata schemas to create descriptive records for each digital object. Metadata includes details such as title, creator, date, and keywords, enhancing discoverability and contextual understanding
3 ORGANISATION AND CLASSIFICATION	Establish a logical and accessible structure for the digital collection, allowing users to navigate and explore content seamlessly	Develop a systematic organisation system, often mirroring traditional archival principles, to classify digital materials. This may include categorising by theme, time period, or format
4 PRESERVATION STRATEGIES	Safeguard the longevity and integrity of digital assets, mitigating risks associated with technological obsolescence and data loss	Implement digital preservation best practices, including regular backups, format migration, and adherence to international standards. This ensures that digital materials remain accessible across evolving technologies
5 ACCESS AND RETRIEVAL	Facilitate user access to digital collections, promoting exploration and engagement	Develop user-friendly interfaces and search functionalities. Provide contextual information alongside digital objects to enhance the user experience. Balance openness with copyright considerations
6 COLLABORATION AND INTEROPERABILITY	Foster collaboration with external institutions and platforms, promoting interoperability and knowledge exchange	Engage in collaborative initiatives, share metadata with relevant repositories, and contribute to broader digital cultural heritage networks. Ensure that digital collections can be seamlessly integrated with external systems



TECHNOLOGY INTEGRATION

Technology integration, as a dynamic component of the digital curator's toolkit, empowers cultural heritage professionals to transcend traditional boundaries, engage diverse audiences, and ensure the perpetual relevance of digital collections in the ever-evolving technological landscape. By staying at the forefront of technological advancements, digital curators contribute to the dynamic evolution of cultural heritage preservation and dissemination. Technology integration is a cornerstone of the Digital Curator's responsibilities, reflecting the strategic incorporation of innovative tools and methodologies to enhance the preservation, accessibility, and presentation of cultural heritage in the digital domain. This facet of the digital curator's role involves leveraging technological advancements to optimize workflows, engage audiences, and ensure the long-term viability of digital collections.

	OBJECTIVE	PROCESS
1 DIGITISATION TECHNOLOGIES	Transform physical cultural artefacts into digital formats for preservation and access	Utilise state-of-the-art digitisation tools such as high-resolution scanners, 3D scanners, and imaging software to create accurate digital representations of physical objects. This process ensures the preservation of fragile materials and facilitates broader access
2 DIGITAL ASSET MANAGEMENT SYSTEMS	Streamline the organisation and retrieval of digital assets through dedicated management systems	Implement digital asset management (DAM) systems that provide a centralised repository for storing, cataloguing, and retrieving digital content. These systems often include features like version control, access controls, and metadata management
3 AUGMENTED AND VIRTUAL REALITY	Enhance user engagement by offering immersive experiences that transcend traditional boundaries.	Integrate augmented reality (AR) and virtual reality (VR) technologies to create interactive exhibits and virtual tours. This not only enriches the user experience but also extends cultural heritage outreach beyond physical museum spaces
4 BLOCKCHAIN FOR DIGITAL PRESERVATION	Ensure the integrity and authenticity of digital assets through blockchain technology	Explore the application of blockchain to create tamper-proof records of digital artefacts. This enhances trust in the digital preservation process, providing assurance of the provenance and authenticity of cultural heritage materials
5 MACHINE LEARNING AND AI	Enhance metadata creation, content analysis, and discoverability through artificial intelligence (AI) and machine learning (ML)	Implement machine learning algorithms to automate tasks such as image recognition, language processing, and metadata enrichment. This accelerates the cataloguing process and improves the precision of content recommendations
6 OPEN ACCESS PLATFORMS AND APIS	Foster interoperability and collaboration by integrating with open-access platforms and APIs	Explore partnerships with open-access platforms, allowing for the seamless exchange of metadata and content. Leverage application programming interfaces (APIs) to integrate digital collections with external systems, broadening accessibility
7 DIGITAL PRESERVATION STRATEGIES	Safeguard digital assets against technological obsolescence and data loss	Continuously assess and update digital preservation strategies to align with evolving technologies. Embrace format migration, emulation, and other techniques to ensure the ongoing accessibility of digital materials

TAKING THE STAKE FOR COLLABORATION

Collaboration, as a fundamental aspect of the digital curator's role, is not merely a means to an end but a dynamic process that enriches cultural heritage through diverse perspectives and contributions. By actively engaging with stakeholders across academic, community, and industry domains, digital curators ensure that cultural heritage remains a living, evolving, and accessible entity for generations to come. Collaboration stands as a cornerstone of the Digital Curator's responsibilities, emphasising the engagement with a diverse array of stakeholders, from researchers to the general public. The goal is to foster meaningful partnerships, promote cultural heritage, and ensure that digital means are effectively utilised to share and amplify the richness of cultural resources.



	OBJECTIVE	PROCESS
1 RESEARCHER ENGAGEMENT	Facilitate collaboration with academic researchers to deepen the scholarly understanding of cultural artefacts	Establish partnerships with universities and research institutions, providing access to digital collections for academic study. Collaborate on research projects, publications, and exhibitions to contribute to scholarly discourse.
2 EDUCATIONAL INSTITUTIONS	Enhance educational outreach by engaging with schools, colleges, and universities	Develop educational programs and resources that align with curricular needs. Facilitate guided tours, workshops, and interactive learning experiences for students to foster a deeper appreciation of cultural heritage
3 COMMUNITY INVOLVEMENT	Build connections with local communities to ensure that cultural heritage is relevant and accessible	Organise community events, workshops, and participatory programs that invite the public to contribute their stories and experiences. Collaborate with community leaders and organisations to integrate local knowledge into digital collections
4 PARTNERSHIPS WITH CULTURAL INSTITUTIONS	Strengthen ties with other cultural institutions to create a network of shared resources	Collaborate with museums, libraries, and archives to exchange expertise, co-curate exhibitions, and share digital assets. Engage in joint initiatives that amplify the collective impact of cultural heritage preservation
5 PUBLIC ENGAGEMENT THROUGH SOCIAL MEDIA	Extend the reach of cultural heritage to a wider audience through social media platforms	Utilise social media channels to share highlights from digital collections, promote events, and encourage public interaction. Leverage platforms such as X, Instagram, and Facebook to create a dynamic online presence
6 CORPORATE AND INDUSTRY COLLABORATION	Explore collaborations with corporate entities to support technological advancements and sponsorships	Seek partnerships with technology companies for innovative projects. Attract corporate sponsorships to fund digital initiatives, exhibitions, or technology upgrades that enhance the accessibility of cultural heritage.
7 INTERNATIONAL COLLABORATION	Contribute to global cultural heritage initiatives by collaborating with international institutions	Engage in collaborative projects, share expertise, and participate in international conferences. Leverage digital platforms to connect with professionals globally, fostering cross-cultural understanding and knowledge exchange.

Required Skills

Digital curators need a diverse skill set that combines traditional archival expertise with contemporary technological acumen. Essential skills include:

Table 3.5 – Required skills for a Digital curator

SKILL	DESCRIPTION
INFORMATION MANAGEMENT	Proficiency in organising and cataloguing digital assets using metadata standards. Importance: Ensures systematic organisation and efficient retrieval of digital materials.
DIGITAL PRESERVATION	Understanding and implementing strategies to ensure the long-term viability of digital materials. Importance: Safeguards digital assets against technological obsolescence and data loss.
TECHNOLOGY PROFICIENCY	Familiarity with a range of digital tools, software, and technologies relevant to digital curation. Importance: Enables effective utilisation of technology to manage and enhance digital collections.
COMMUNICATION SKILLS	Clear and effective communication to collaborate with various stakeholders and convey the significance of digital heritage. Importance: Facilitates collaboration with researchers, educators, the general public, and other professionals.
INTERDISCIPLINARY KNOWLEDGE	Understanding of diverse disciplines, including archival science, information science, cultural heritage studies, and technology. Importance: Allows for a holistic approach to digital curation, incorporating principles from various fields.
RESEARCH SKILLS	Ability to engage in scholarly research to contribute to the understanding of cultural artifacts. Importance: Facilitates collaborations with researchers and ensures informed decision-making in digital curation.

SKILL	DESCRIPTION
COLLABORATION AND TEAMWORK	Ability to work collaboratively with diverse teams, including researchers, educators, community members, and other professionals. Importance: Fosters partnerships and ensures a collaborative approach to managing digital collections.
PROJECT MANAGEMENT	Skills in planning, organising, and executing digital curation projects. Importance: Ensures the successful implementation of digital initiatives within specified timelines and resources.
CRITICAL THINKING	Analytical and critical thinking skills to assess challenges and develop effective solutions. Importance: Essential for addressing complex issues related to digital preservation and access.
FLEXIBILITY AND ADAPTABILITY	Ability to adapt to evolving technologies and changing project requirements. Importance: Ensures that digital curators remain responsive to advancements and challenges in the digital landscape.
LEGAL AND ETHICAL UNDERSTANDING	Knowledge of copyright laws, intellectual property rights, and ethical considerations in digital curation. Importance: Ensures compliance with legal standards and ethical practices in managing digital collections.
USER EXPERIENCE DESIGN	Understanding of user-centric design principles to enhance the accessibility and usability of digital collections. Importance: Promotes positive user experiences and engagement with digital heritage.
CONTINUOUS LEARNING	Willingness and ability to stay updated on emerging technologies and best practices in digital curation. Importance: Ensures ongoing relevance and adaptability in the rapidly evolving field of digital curation.

These skills collectively empower a digital curator to navigate the complexities of managing, preserving, and promoting cultural heritage in the digital age. They contribute to the effective stewardship of digital assets and the meaningful engagement of diverse audiences with cultural resources.

Mapping of Best Practices in Digital Curation

Chapter 3.3

Antonia Agapiou

In an era of technological advancements, cultural heritage institutions worldwide are embracing digital tools to enhance accessibility, engagement, and preservation of their rich collections. Museums and heritage sites across Europe are employing a diverse range of digital practices, from web-based innovations and virtual tours to emerging technologies and innovative educational programs.

A comprehensive understanding of the DC profile was sought through a state-of-the-art review, delving into the impacts of the digital revolution on this role. The review extended to policy documents from the year 2000 onward, with particular attention given to the challenges and opportunities in the field of digital humanities, including recent EU projects, emerging perspectives, and trends, as you have read in the previous paragraphs.

The initial focus was placed on two parts: 1) how museums have embraced digital technologies and 2) the opportunities for students to acquire skills shaping a new museum curator profile. In addressing the challenges and skills required for

professional training, DCbox conducted an overview of the national landscape related to the digital transformation in museums across Cyprus, Greece, Italy, Portugal, Serbia, and Spain. This included a review of national educational programs and insights into opportunities and challenges faced by these programs.

Examples of higher education programs and relevant courses supporting the development of Digital Curator competencies were highlighted, with criteria for selection encompassing broad relevance, explicit mention of “Digital Curator” among targeted occupational profiles, and inclusion of keywords and skills such as data curation, virtual content design, storytelling, social media strategies, and digitisation process management.

Further exploration into how museums have embraced digital technologies involved a mapping exercise of digital practices in museums and heritage sites across Europe, aiming to gather and analyse information on best practices related to digital cultural heritage tools and strategies. To assess the extent of digital applications in museums and heritage sites, each partner conducted a mapped exercise analysing local case studies. The qualitative assessment considered factors such as user engagement, non-specialised equipment requirements, and outreach capabilities.

The findings, as can be seen in Figure 3.9 below, indicated a horizontal distribution of web applications (e.g., virtual tours) across all partner countries, while more specialised applications decreased due to increased costs, complexity, and maintenance challenges. The sustainability of digital content over time emerged as a key concern, emphasising the need for adaptability to new technological advancements.

Our analysis provided a detailed breakdown of digital tools and technologies by country, revealing distinctions in usage patterns. “Web” tools, particularly in Portugal and Germany,

stood out, while innovative technologies like Non-Immersive VR and AR Vision-Based found prominence in Italy. The discussion also touched on the cost-effectiveness of certain tools, noting that as the complexity and expense of technology increase, its frequency of use tends to decrease. Availability of specialised equipment and expertise also present a challenge as equipping museums with the necessary technologies and training personnel in their use can be a significant investment. Creating a seamless and engaging experience that smoothly integrates physical and digital elements is essential for maximising the impact of digital initiatives. This in turn can attract younger visitors and create educational programmes for children in museums. A critical consideration however for sustainable implementation is highlighted through the mapping exercise to ensure that any technology used will be able to respond effectively to technology updates and changes.

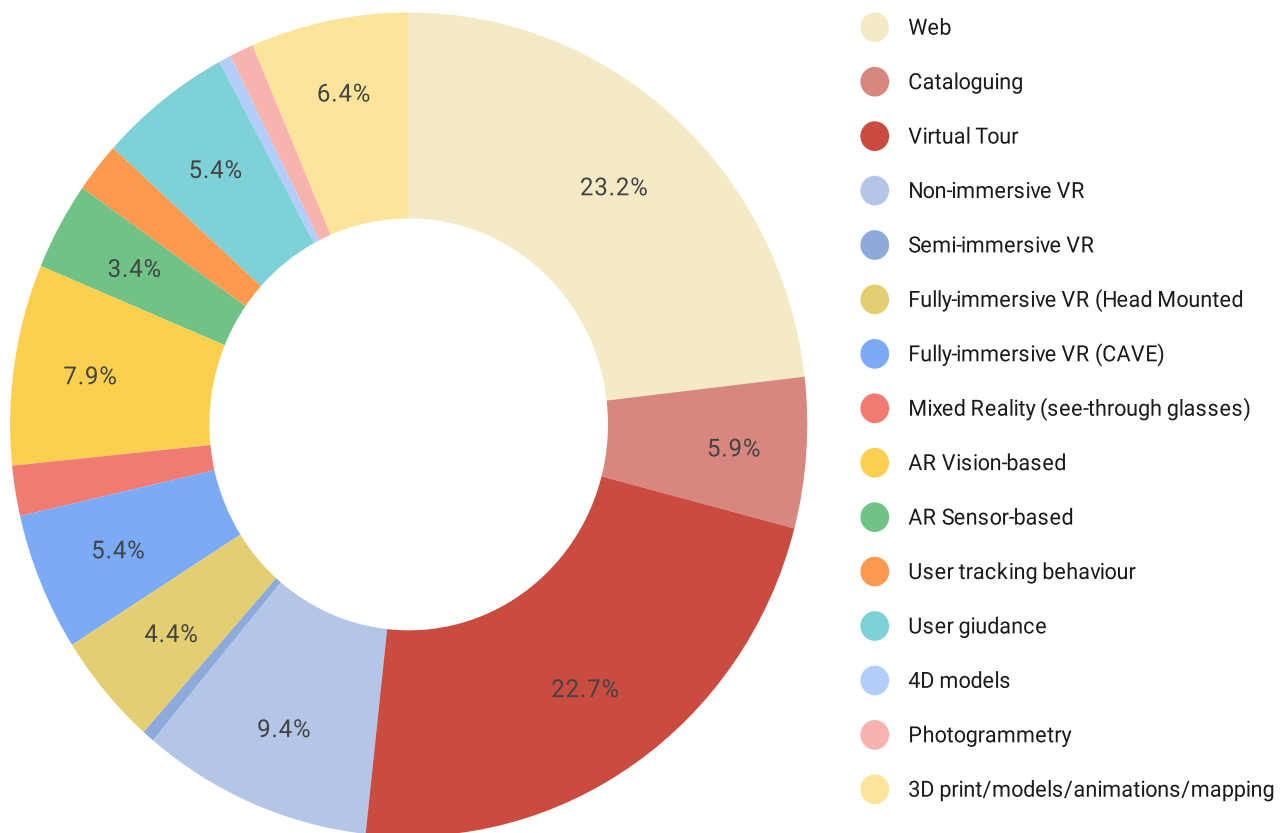


Fig. 3.9 - The results of the mapping exercise through a statistical analysis



CHAPTER 4

The DCBox Training Approach

The DCbox Training Approach

Chapter 4.1

Cristina Stefanelli, Ramona Quattrini

Based on the results achieved (and presented in previous chapters) through the research on the emerging needs in the field of digital curation, DCbox developed a training approach to support the development of the necessary skills identified as key to becoming a Digital Curator.

The DCbox full learning experience foresees:

- an online open course on digital curation
- a living LAB to develop prototypes under the academic supervision of teachers and trainers and
- a traineeship in relevant organisations and institutions (mainly museums) in order to assess if the prototype is satisfying the needs of the organisation and of its target groups.

The online course **“Supporting the Digital Transformation of Museums. The DCbox approach”** aims to encourage the competence building of museums curators and students interested in cultural heritage-related careers in the field of digital transformation.

The course provides training on how digital transformation can enhance the offer of cultural institutions (museums, archives, etc.) and supports current and future experts in exploiting successfully all the potential of digital technologies and tools.



The course is available in English at <https://moodle.dcbox.eu> and was piloted by 28 students from the partner universities between March and October 2023. The course, enrolled the students in the following Higher education courses: Digital Cultural Heritage; Building Engineering and Architecture; Tourism; Engineering and Architectural Representation and Drawing; Management of Cultural and Natural Heritage in Urban and Rural Environments; Architecture; Educational Sciences and Arts; Computers Animations, Computer Graphics, Multimedia and Computer Design.

DCbox adopts the Bloom's Taxonomy (Bloom et al., 1956) as a pedagogical framework for the definition of learning objectives and outcomes. The taxonomy, first published in 1956, places educational goals into specific categories to enable a better assessment of learners:

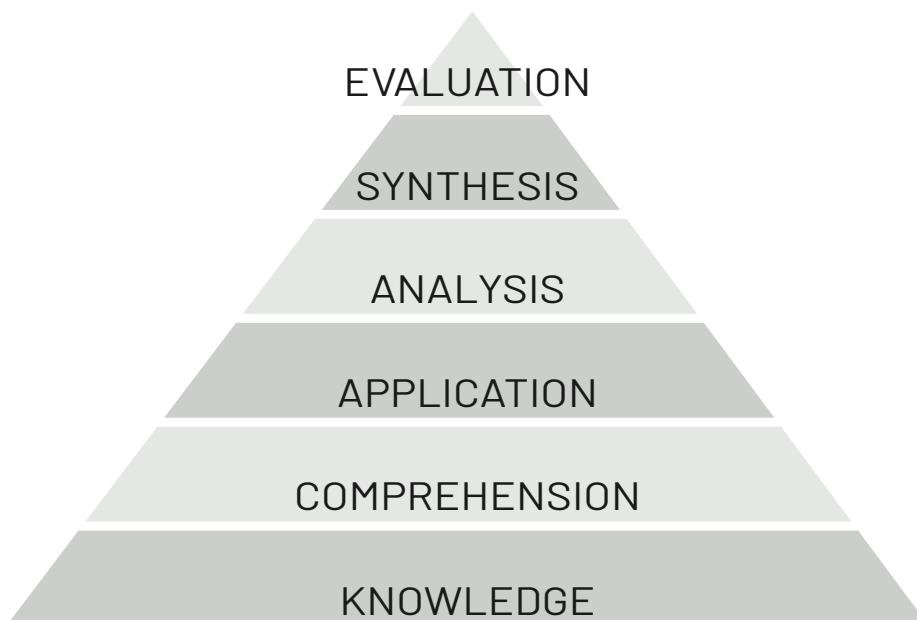


Fig 4.1 - The Bloom Taxonomy (Bloom et al., 1956)

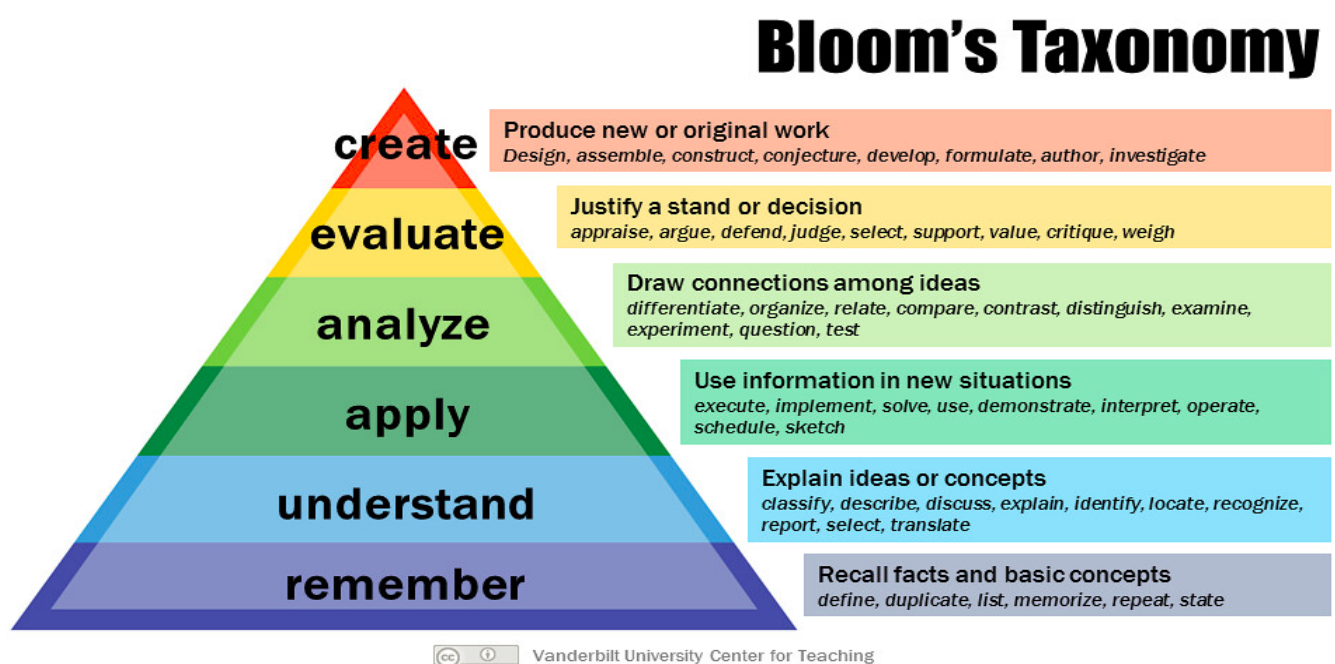
In the pyramid, basic skills lie at the bottom, and more advanced ones are set at the top. As students progress, they make their way to the pinnacle. Whilst initially developed to enable assessment, Bloom's taxonomy became used by teachers and trainers to define the curriculum, design learning objectives and outline classroom activities. In 2001, a revised taxonomy was published (Armstrong, 2010), featuring the following changes:

Category names changed from nouns to verbs to reflect that learning is an activity.

Switched position of the two top categories with creation (creating) reaching the top of the pyramid (and of the learning hierarchy).

Introduction of the idea that each level of the pyramid (representing a knowledge dimension) can be broken down into four degrees of knowledge: factual, conceptual, procedural and metacognitive.

Fig 4.2 - The Bloom Taxonomy Revised



In promoting an integrated approach to our DCbox course design, including the importance of aligning the learning outcomes with the teaching and learning activities developed and the techniques used for feedback and assessment, we aimed for the online course to create a significant learning experience for those involved.

The list below presents an overview of the competencies that the course aims to support:

Ability to:

- describe what digitisation of Cultural Heritage is
- determine the main digital curator's skills
- define some technological innovations for museums
- process data and deliver accurate results
- assess and evaluate Cultural Heritage Projects
- manage Digital Cultural Heritage taking particular account of international and European guidelines and rules
- guarantee the interchanging and preservation of Digital Cultural Heritage using the Open Formats
- use marketing principles and strategies
- to preliminary design a museum website
- manage and adapt Digital Cultural Heritage to the EN and ISO standards
- conceptualise and develop a simple applications for cultural field

Capacity to:

- optimise 3D data for different kind of purposes
- develop good strategies for the cataloguing and information management of Digital Cultural Heritage

- model data using the Entity-Relationship (ER) and the Enhanced Entity Relationship (EER) Models
- define and evaluate the best XR solution on some real cases
- draft the most common assessment questionnaires
- conduct a simple survey on a museum application
- use planning and data collection skills according to the most appropriate methodology
- master different methods for reality and non-reality-based 3D modelling

Being aware of:

- the main Extended Reality technologies for Cultural Heritage
- 3D modelling related projects exploiting active (3D scanners) and passive sensors (DSLR cameras)
- the importance of Organisation and Management in developing and running innovative information systems
- the framework of digital dissemination for the Cultural Heritage

See below a complete overview of the competencies related to each module.

The following criteria were adopted concerning the access, delivery and assessment of the online course during its piloting phase:

1. The course is delivered as a MOOC (Massive Online Open Course) on Moodle.

2. Addressing a broad audience (students/professionals) active in different fields (Engineering, Humanities, ICT, Architecture, Arts), the course is organised in areas and modules as shown below. From a sustainable perspective, this structure allows in the future for flexible access to the relevant modules one may want/need to acquire missing competencies and knowledge, paving the way for the delivery of micro-credentials with this course.

AREA A	Module 1
DIGITAL TRANSFORMATION OF CULTURAL HERITAGE	Digital Transformation in Cultural Heritage
AREA B	Module 2
ADVANCED 3D DIGITIZATION	Digitization
	Module 3
	3D Modelling and data Implementation
AREA C	Module 4
POLICIES AND DIGITAL DATA PRESERVATION	Policy rules and licensing
	Module 5
	Digital Data Preservation
AREA D	Module 6
DIGITAL ACCESS: UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES	Communication and marketing strategies in Cultural Heritage
	Module 7
	Virtualisation
	Module 8
	New frontiers in Cultural Heritage

3. Although designed specifically for students and/or professionals in the field of Arts, Engineering and Architecture, the course is open to anyone interested; it has no access requirements.
4. Two kinds of learners are foreseen: those being part of the pilot phase (having access to the online course and related tutoring and assessment services) and those who have access to the online course but not to tutoring and assessment. The first group is defined as “Qualified” students, the second were defined as “Self-Enrolled”. Qualified users can have access to the Activities: practical tasks planned to test the concepts explained during the lessons.
5. Learners will get two different badges depending on their achievements: a badge certifying participation for those learners having completed all modules or a badge certifying the acquisition of the competencies and knowledge for those having completed all course modules, quizzes and activities and being part of the pilot. The latter badge states the achieved competencies and knowledge and the number of hours spent on the course (to enable institutional recognition in terms of ECTS where possible).

As mentioned above, in some modules of the MOOC, qualified users will find practical activities designed to learn new skills with simple assignments. Those activities are not mandatory, and their submissions were supported and reviewed by “Tutors” who are DCbox team members specialised in the topics included in that exercise. Here follows the list of activities designed by the partnership alongside the competencies and the description of the activities provided to the students.

COMPETENCIES ADDRESSED BY THE ACTIVITIES

To be able:

- to process point cloud data and deliver accurate results
- to develop good strategies for the cataloguing and information management of Digital Cultural Heritage

- to preliminary design a website
- to develop a simple XR application
- to conduct a simple survey on an application.

ACTIVITIES' DETAILS

DCbox proposes along the course five different activities:

POINT CLOUDS ALIGNMENT

TUTOR	Daniele Arturo De Luca
DESCRIPTION	In this activity the learner is guided through the workflow for point cloud alignment. A step-by-step booklet is provided highlighting all the tasks
EXPLANATION	Upload a screenshot of the clouds aligned with the report as shown in the tutorial

DIGITAL CATALOGUING TOOLS AND TECHNIQUES

TUTOR	Massimo Gasparini
DESCRIPTION	Through this activity the learner will be able to organise a catalogue file.
EXPLANATION	Following the previous lessons this activity the learner will be able to organise a catalogue file with the mentioned examples. As subject the learner can select a heritage asset from his/her town or community that is not listed in Europeana and he/she will create its catalogue file following the structure studied. Once the file is completed, it must be accompanied by a brief report explaining points detailed in the activity.

MAKING OF A WEBSITE

TUTOR	Ricardo Geraldes
DESCRIPTION	In this activity the learner will be able to create a website homepage by following a website tree structure that is essential to organize the information flow of a website.
EXPLANATION	Following the lessons of this module, the students will be guided through the creation of a website homepage with the implementation of one of the three essential structures to build a website: sequences, hierarchies and webs. By implementing these fundamental architectures, the students will start to organize the information workflow of the website, regarding Cultural Heritage in Museums context.

HOW TO DEVELOP A MOBILE APP

TUTOR	Mirco D'Alessio, Daniele Arturo De Luca
DESCRIPTION	In this tutorial all the steps to develop a simple mobile application exploiting Augmented Reality will be shown.
EXPLANATION	Submit a video screen capture of the built application, during its functioning

EVALUATION QUESTIONNAIRES DEVELOPING

TUTOR	Andjela Djordjevic
DESCRIPTION	In this activity all the steps to develop a simple questionnaire about a virtual tour will be shown. Literature containing basic rules for creating questionnaires and formulating questions will be proposed to the students
EXPLANATION	Submit the prepared questionnaire

While the DCbox MOOC serves as introductory content, its effectiveness can be further enhanced through complementary initiatives: since it was established, in the application form, that the students should be involved in a Living Lab dealing with the realisation of digital curatorial prototypes and then, or also in parallel, to spent time in cultural institutions and museums for a traineeship. These different learning experiences serve to reinforce the theoretical background. Once the designing activity is a crucial part of the needed competencies and skills, it can be learned when working with specific case studies. Thus, the main path foresees to acquire the capacity to manage a curatorial project from the design to the development as well as the capacity to set up it a real case scenario and to adapt and assess the idea and the workflow for the curatorial work to the needs of specific institutions. This approach enables participants to put theoretical knowledge into action in real-world situations, promoting a practical comprehension of digital curation practices and developing effective skills ready for the job market.

Competencies, Learning Outcomes and KPI of the DCbox Learning Experience

Chapter 4.2

Ramona Quattrini

In this chapter, it is possible to delve into a comprehensive exploration of competencies, learning outcomes, key performance indicators (KPIs), and the development of an evaluation rubric within the context of the dynamic learning experience of the DCbox project. Our focus centres on the intersection of competencies, specifically those related to digital cultural heritage and the design of museum exhibits. As we navigate this terrain, we aim to elucidate the relationship between theoretical knowledge and practical application. By establishing clear competencies and learning outcomes, accompanied by measurable KPIs and a robust evaluation rubric ([see Table 4.2](#)), we lay the foundation for an enriched educational journey that not only equips learners with essential skills but also provides an initial understanding of the complexities inherent in digital curation and exhibit design for cultural heritage.



Table 4.1 – List of competencies addressed by the DCbox MOOC

AREA	MODULE	COMPETENCIES – TO BE ABLE TO:
A	1	- to describe what digitisation of Cultural Heritage is. - to determine the main digital curator's skills. - to define some technological innovation for museums.
B	2	- to complete 3D modeling-related projects exploiting active (3D scanners) and passive sensors (DSLR cameras). - to plan and collect data according to the most appropriate methodology. - to process data and deliver accurate results.
	3	- to develop and master different methods for reality and non-reality-based 3D modelling. - to post-process and optimise 3D data for different kinds of purposes. - to Assess and evaluate Cultural Heritage Projects.
C	4	- to manage Digital Cultural Heritage according to international and European guidelines and rules. - to guarantee the interchangeability and preservation of Digital Cultural Heritage using the Open Formats. - to manage and adapt Digital Cultural Heritage to the EN and ISO standards.
	5	- to develop sound strategies for the cataloguing and information management of Digital Cultural Heritage. - to model data using the Entity-Relationship (ER) and the Enhanced Entity Relationship (EER) Models. - to understand the importance of Organisation and Management in developing and running innovative information systems.
D	6	- to understand the framework of digital dissemination for the Cultural Heritage. - to use marketing principles and strategies. - to preliminary design a museum website.
	7	- to distinguish the main Extended Reality technologies for Cultural Heritage. - to define and evaluate the best XR solution based on some real cases. - to conceptualise and develop simple applications (for instance for museums).
	8	- to distinguish the main AI technologies for Cultural Heritage. - to define most common assessment questionnaires. - to conduct a simple survey on a museum application.

AREA	MODULE	LEARNING OBJECTIVES	LEARNING OUTCOMES
A	1	■ To become aware of the importance of preserving and enhancing Digital Cultural Heritage. ■ To explain terms like museology, museography, digital humanities, digital twins, and digital heritage. ■ To become aware of the role of the museum's curator throughout the years. ■ To define the requested humanistic and digital skills to participate in digitization processes.	At the end of the first module, learners will own some basic concepts and principles as regards Digital Cultural Heritage and the involved processes. Students will become aware of some essential keywords like digitization, digitalization, museology, digital humanities, and digital twin, and will be exposed to a brief overview of the curator's figure since the 15th century to the modern digital age. The essential humanistic and digital skills of a digital curator will be discussed to preserve, enhance and disseminate Cultural Heritage.
	2	■ To understand the main difference between active and passive sensors. ■ To be able to select the most appropriate technique according to the specific project goal. ■ To understand the full range-based 3D modelling pipeline for data processing: from range maps to a complete 3D model. ■ To understand the full image-based 3D modelling pipeline: from images to a complete 3D model. ■ To understand the potentialities of high-resolution imaging techniques. ■ To be able to process 3D data by exploiting a wide array of software. ■ To understand how to assess the conservation conditions exploiting range-based techniques and perform basic analysis of objects of different scales.	By the end of the Module, the students will develop the competencies that allow them to plan, perform, process the collected data, and deliver a high-resolution accurate 3D model or a digital-related product. They will be introduced to the use of several sensors installed on aerial and terrestrial platforms. Hands-on exercises, exploiting open source and commercial software, will give them the chance to practice on real case studies, challenging themselves with open questions and solutions.
B	3	■ To understand and practice of 3D modelling and data optimization. ■ To study and assess direct and procedural modelling through the analysis of real case studies. ■ To perform and complete virtual restoration and 3D modelling restoration tasks through practical exercises.	By the end of the Module, the students will have a broad understanding of the techniques to process, optimize and manage reality and non-reality-based 3D models. They will be introduced to the use of different post-processing software and 3D data ranging from small objects to monumental scale. Students will have the chance to analyse and discuss on real case studies, developing an analytical and critical thinking process.

AREA	MODULE	LEARNING OBJECTIVES	LEARNING OUTCOMES
C	4	■ To learn about the International Conventions and the European and national laws related to Digital Cultural Heritage. ■ To be able to define what Digital Cultural Heritage is. ■ To be introduced to intellectual property laws in connection to cultural institutions and Digital Cultural Heritage. ■ To understand the EN and ISO standards regarding the management of digital sources and adapt them to Digital Cultural Heritage. ■ To learn about the Open Data Formats that can be used for Digital Cultural Heritage. ■ To be able to promote standardized interoperability and interchanging of Digital Cultural Heritage between institutions	By the end of the module the students will develop the competencies that allow them to manage Digital Cultural Heritage according to the European and international conventions and guidelines. They will be able to adapt the EN and ISO standards about digital sources to standardise Digital Cultural Heritage for the international scenario. In addition, they will be able to use the Open formats for the preservation of digital cultural heritage
	5	■ To learn the methodologies for cataloguing Cultural Heritage. ■ To be able to define the main areas of interest aimed at communicating and enhancing the cultural heritage. ■ To understand Database System Concepts and Architecture. ■ To create database queries. ■ To learn the basic concept of Structured Query Language (SQL). ■ To be able to create strategic and long-term planning information management system	By the end of the module, the students will be able to develop state-of-the-art strategies regarding the preservation and interchanging of digital data and they will acquire the knowledge that allows them to develop long- and short-term plans for the information management and cataloguing of Cultural Heritage. In addition, the students will be able to understand data models, interact with existing databases and collaborate with software engineers to design data-centric applications focused on Digital Cultural Heritage

AREA	MODULE	LEARNING OBJECTIVES	LEARNING OUTCOMES
D	6	- To understand the framework of digital dissemination for the Cultural Heritage. - To acquire some marketing principles and strategies. - To preliminary design a (museum) website	By the end of the course, students will develop the competencies that allow them to orient themselves in the world of digital tools, especially about the relationship between cultural heritage and the public. With the presentation of tools like website, video production and podcasting, students will be able to ideate a hypothetical museum website.
	7	- To learn the main concepts, enabling technologies, and key applications for XR in CH. - To recognize strengths and weaknesses of VR and AR for new XR applications. - To become aware of the main applications for web, mobile and wearable devices. - To develop a simple XR application.	By the end of the module, students will be able to reason conceptual and technological differences between VR, AR, MR, and XR. Furthermore, they will learn the underlying concepts, enabling technologies, and key applications for XR in cultural heritage. In the activity, students will choose the most effective technology based on some real case scenario. In addition, students will be able to recognize and classify all the applications according to the technology and the device, and will gain a good knowledge of some common software. Furthermore, students will test an available platform for the development of new XR experiences for a museum collection.
	8	- To explain terms like Machine Learning, Deep Learning and Neural Networks. - To become aware of best practices of AI in heritage science. - To become aware of the most common assessment questionnaires and their underlying concepts. - To design and conduct a simple survey on a museum application	By the end of this module, students will learn what Artificial Intelligence (AI) is, explore concrete cases and applications of AI, and understand AI concepts and terms like machine learning, deep learning and neural networks. They will become aware of some key applications of AI in Heritage Science employing by means of the best-case studies of the last years. Moreover, they will acquire an overview of the most common assessment questionnaires and will be able to explain terms like level of engagement and level of readiness. Finally, they will carry out an activity designing and producing a simple assessment questionnaire about a museum application.

The Learning Modules

Chapter 4.3

Daniele A. De Luca, Olesya Ivanova

An important core of the DCbox project is represented by the online learning modules, which can be accessed through the DCbox website, allowing users to start with the learning experiences. This is structured by the partners in the previous project phases.

Website

The course can be accessed either via the link directly from the project's webpage www.DCbox.eu or at: <https://moodle.DCbox.eu/>. The modules are divided into four main areas and a VR Module (which will be discussed in VR Module paragraph of this chapter).

Fig. 4.3 - DCbox website homepage



Home DCbox project ▾ DCbox map Team&Communities ▾ News&Events ▾

Learn with us!

Moodle

**CAPACITY
RESILIENCE
DIGITAL READINESS**

Enabling a new generation of European professionals
in the field of Digital Cultural Heritage

DCBOX
MAP

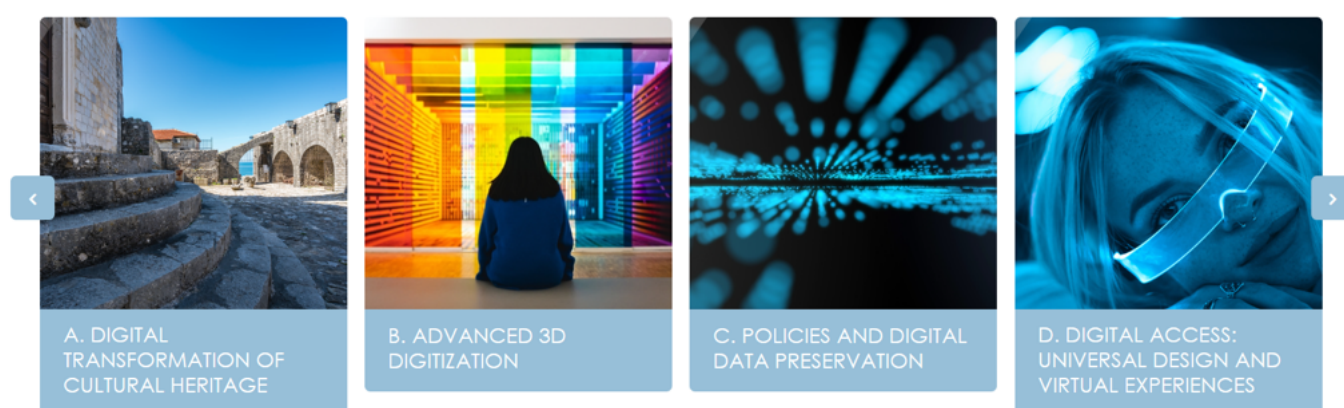
Areas and VR Modules

The four areas are designed to be completed sequentially by the learners.

Once the first area is completed, an access key is given to the next one, until the entire course is completed.

Fig. 4.4 - DCbox Moodle homepage

Available courses



The four areas are designed to be completed sequentially by the learners. Once the first area is completed, an access key is given to the next one, until the entire course is completed.

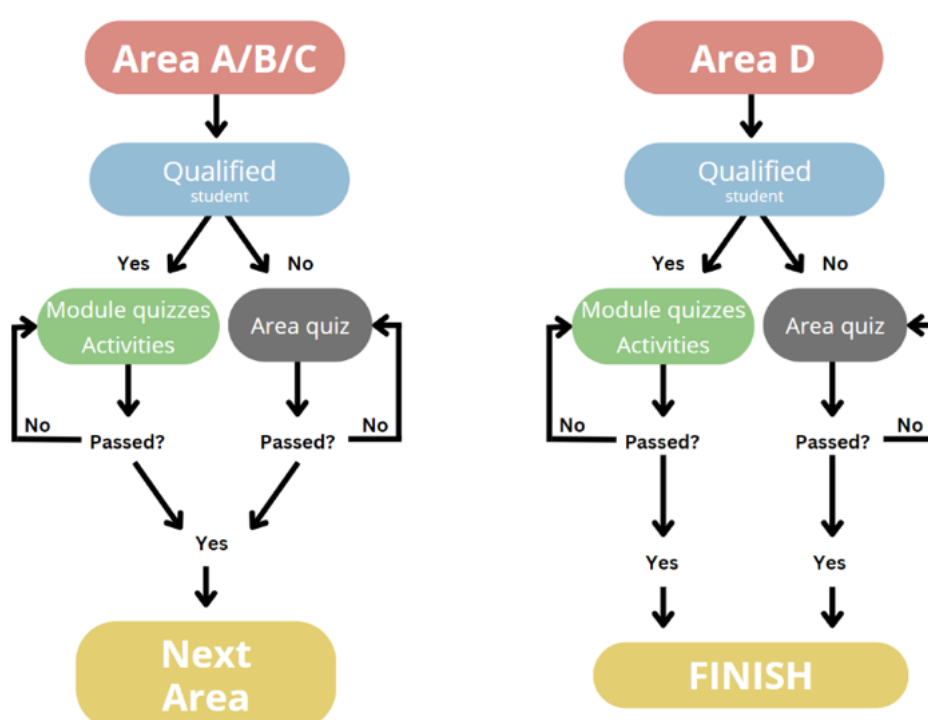
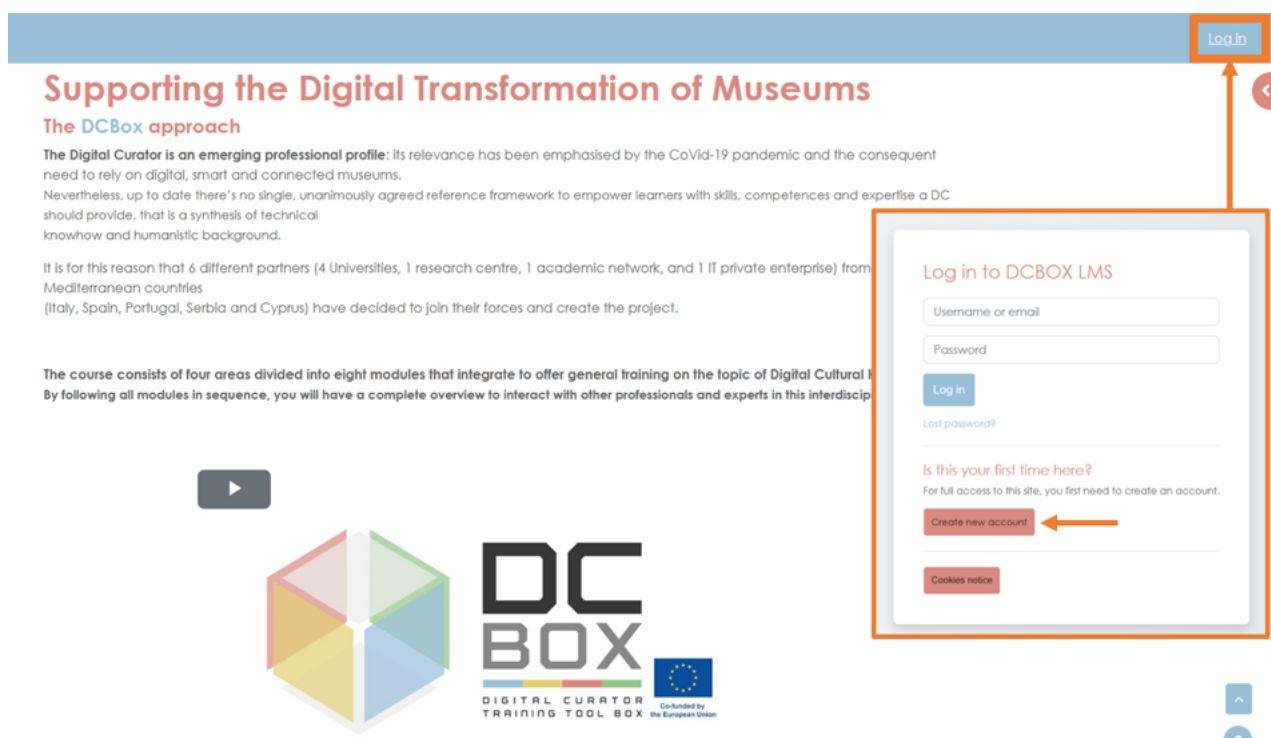


Fig. 4.5 - The consequential steps to be followed in the DCbox MOOC

Account Creation

Two learners' profiles enable to access the content, in particular the students who participated in the piloting phase of the project, were defined as **"Qualified"** students, while all other students who participated in the course externally, were defined as **"Self-Enrolled"**. Qualified users, have access to the **Activities**, and practical tasks planned to test the concepts explained during the lessons. The activities are only proposed to the learners but are set as not-mandatory activities. However the activities are still present in the Learning Management System as possible didactic contents and can be reactivated, as possible outlook, if in the future the DCbox partnership can afford to launch another tutored edition of the course.

Fig. 4.6 – DCbox LMS account creation



Course Enrolment

Starting from the previous distinction, the course enrolment is possible in three ways:

- Via back-office through the data provided to the DC-box managers;
- Via Moodle website, for **self-enrolled** students, in the “log in” section;
- Via Moodle website, for **guests**, in the “log in” section. The Guest access allows users to view the contents of a course but not to participate in any learning tasks.

Once completed the registration, the users can start with the course. To enrol on the first area, the learner has to click on “AREA A: Digital Transformation of Cultural Heritage”, All Areas enrolled are then displayed in the section “**My courses**” in the up right corner of the page.

Fig. 4.7 - Activation and self-enrolment in a single area

The screenshot shows the Moodle interface for the DCBOX course. At the top, there is a navigation bar with the DCBOX logo and links for Home, Dashboard, My courses, and Dcbox site. Below this, the course title 'A. DIGITAL TRANSFORMATION OF CULTURAL HERITAGE' is displayed in red. Underneath, the section 'Enrolment options' is visible. The course description follows, explaining the importance of digital heritage and the role of digital curators. The 'Area Administrator' is listed as Ramona Quattrini. In the 'Self enrolment (Student)' section, it states 'No enrolment key required.' and features an 'Enrol me' button, which is highlighted by a yellow arrow. A help icon (?) is located in the bottom right corner.

Area Structure

Each area follows the same structure, visible in the figure.

✓ Announcement (teachers -> students)	Communicate
✓ Forum (teachers <-> students)	
✓ Tutors	Support
✓ Video	Educate
✓ Presentation	
✓ Support material	Support
✓ Activity	Evaluate
✓ Quiz	

In the **“General”** section, the user can find an overview of the Area and some useful information. The **“Announcements”** and the **“Forum”** are available per each area to communicate with the students, to share common questions and avoid repetitive need for information.

Fig. 4.8 - Sub-sections of each single area, with their main objective

FIRST AREA: PRE-ASSESSMENT QUIZ

Before starting the course, learners have to complete a “Pre-Assessment Questionnaire”, in order to assess their knowledge and skills before the course. Simple questions are posed about their competencies in the field related to the DCbox learning course. At the end of the course a “Post-Assessment Questionnaire” is submitted to track their progress. This contains also additional questions, more specifically regarding the acquired competencies.

TEACHERS

Each area has assigned different teachers and responsible tutors: their profiles can be found in the related section called “Teachers”. Here the learners can consult a brief Bio of each person and contact them directly via personal chat to ask for help if needed.

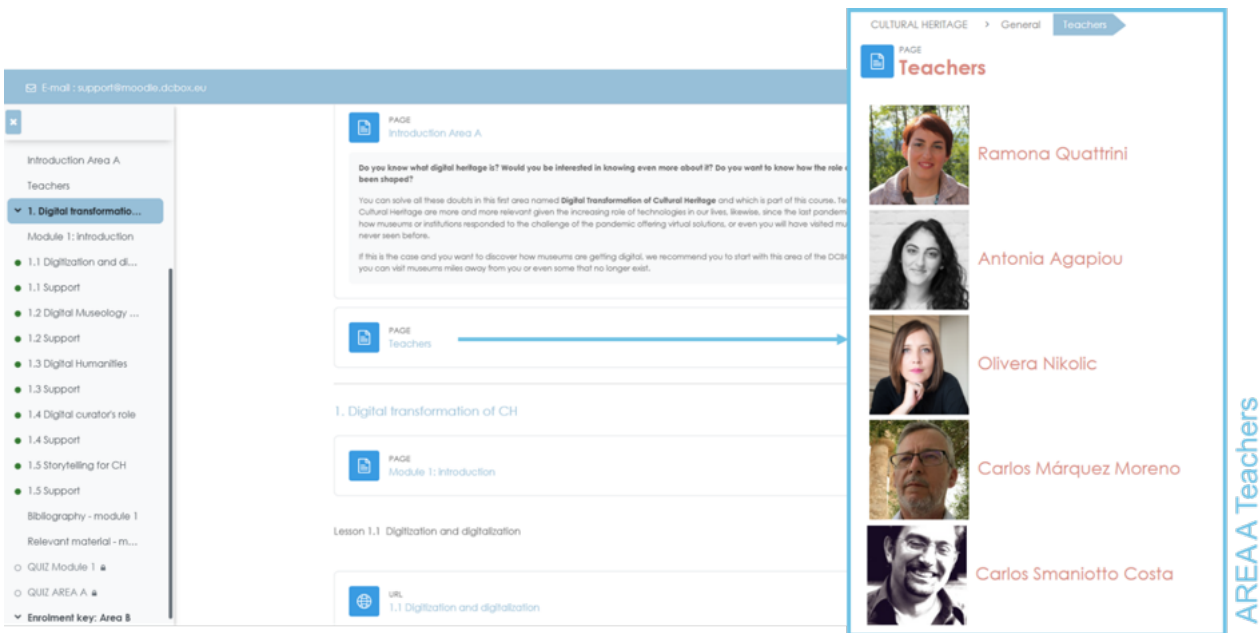


Fig. 4.9 - The MOOC section about teachers

MODULE INTRODUCTION

Diving into the course, students will find the modules in which the area is divided. The first section of the module is the **“introduction”** which contains an overview of the topics and a brief syllabus of the contents, competencies and learning objectives of the current one.

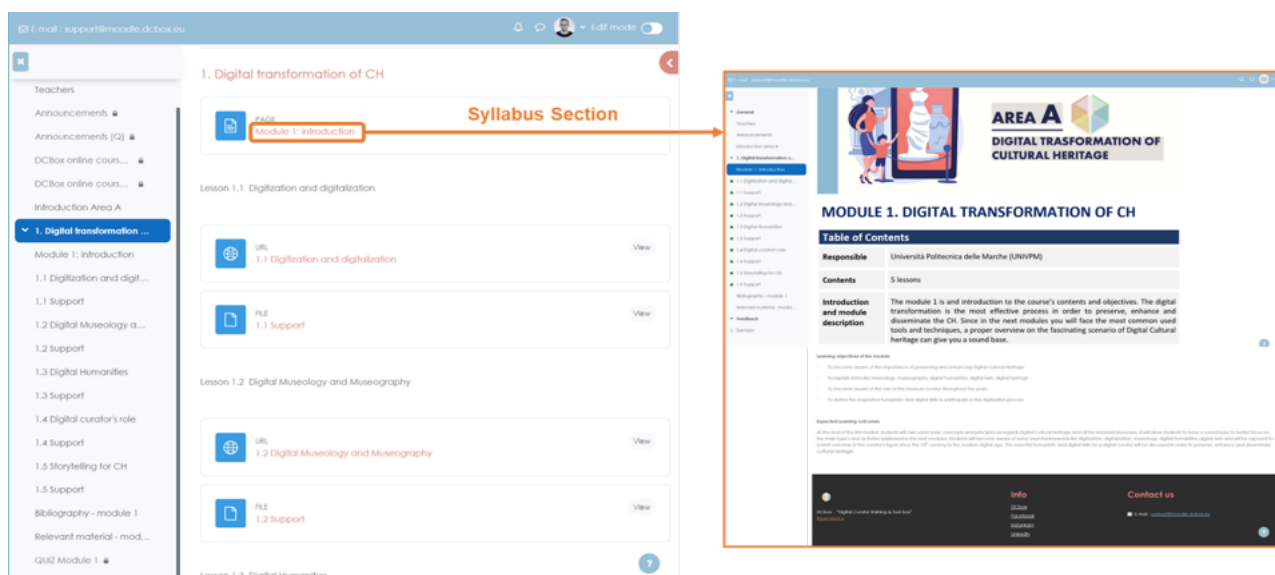


Fig. 4.10 - The introductory section of a module

COURSE MATERIALS

Each module has a variable number of lessons, regarding specific topics, which are structured with a video lesson and a support file containing the slides used by the teachers.

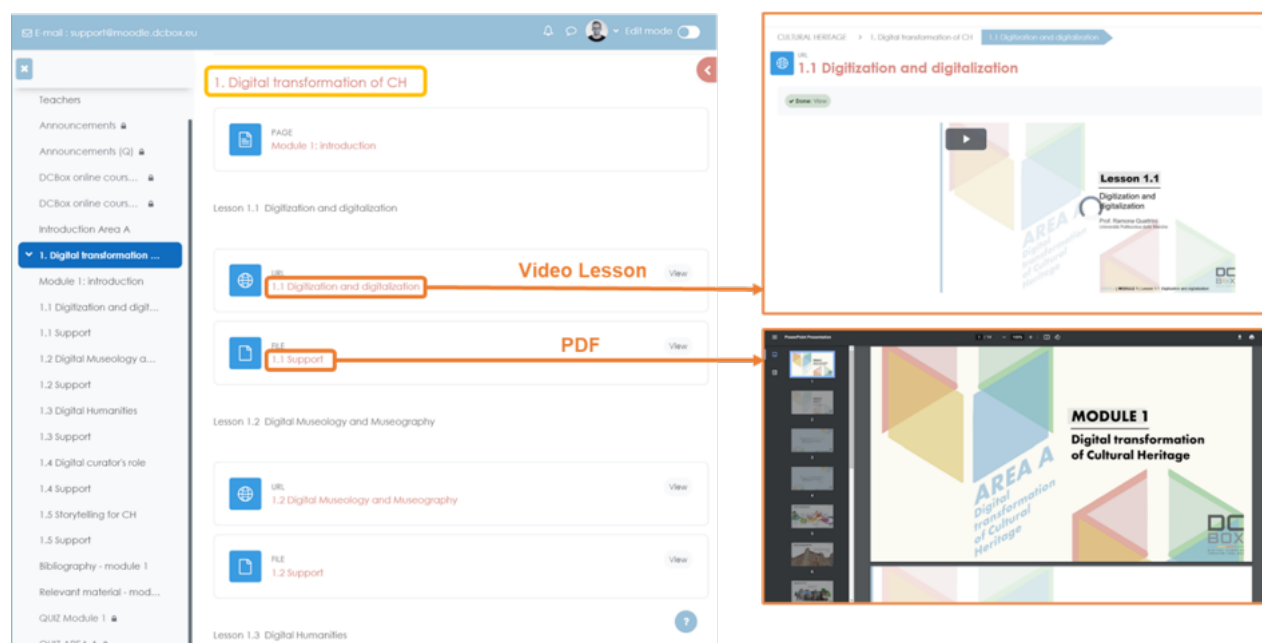


Fig. 4.11 - The section of a lesson, with possible material (video, support materials etc.)

VIDEO LESSONS

Each video has been uploaded to YouTube and then embedded into the platform. This was made mainly for two main reasons: to not overload the platform server with lots of gigabytes of files and to allow better accessibility via subtitles. Opening the video in the YouTube external player allows learners to activate subtitles and even select a different language. At the moment, the only verified language is English but some lessons have been translated into Spanish by our partners from the University of Cordoba and more languages can be easily set up via YouTube without entering the Moodle Back Office, which requires specific competencies (see Fig. 4.12).

USEFUL LINKS AND RESOURCES TO EXPAND THE KNOWLEDGE

After the list of lessons, each module concludes with a specific section containing all the bibliographic references and other relevant material, useful to expand the knowledge and give an in-depth study about the module's topics (see Fig. 4.13).

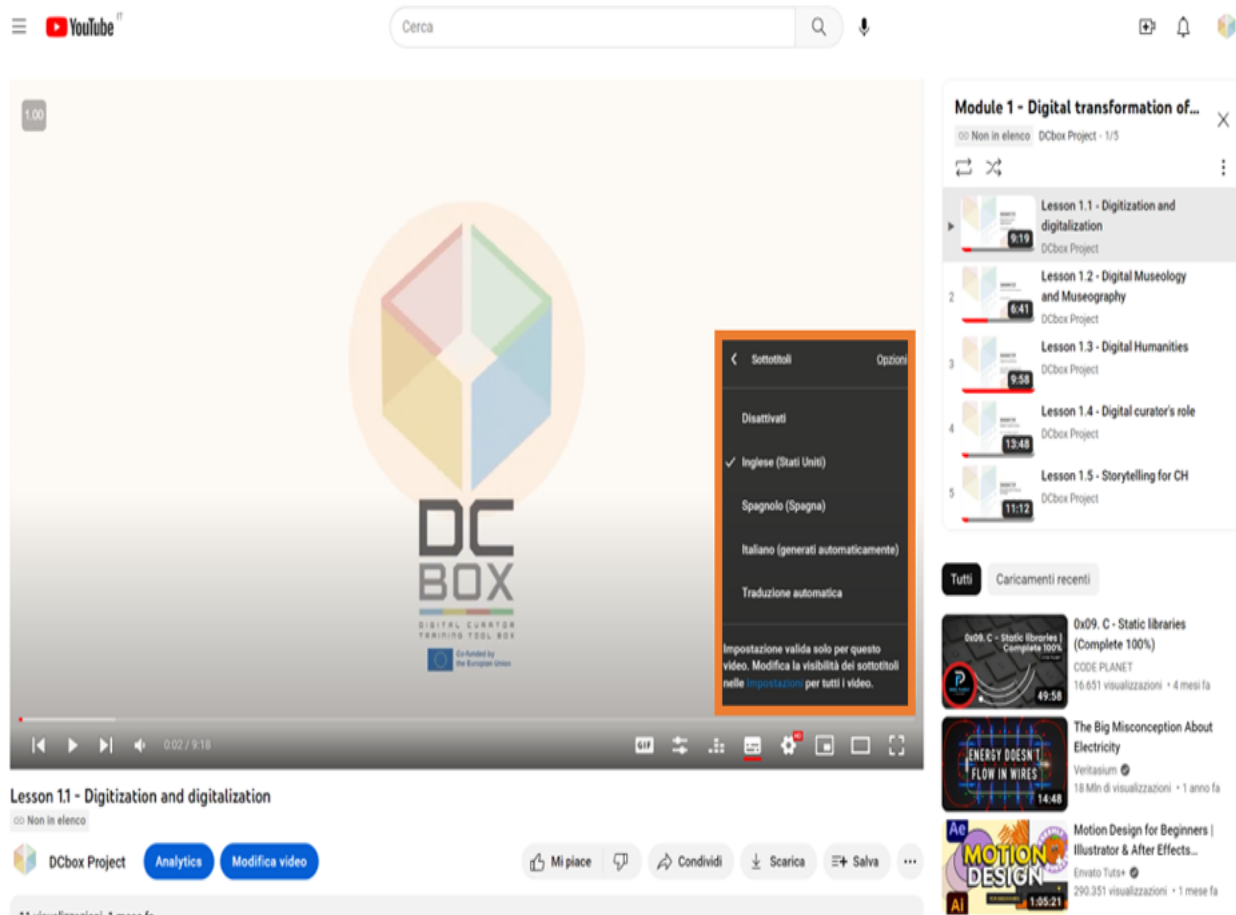


Fig. 4.12 – Visualization of a DCbox video-lesson in YouTube, with the possibility to activate subtitles

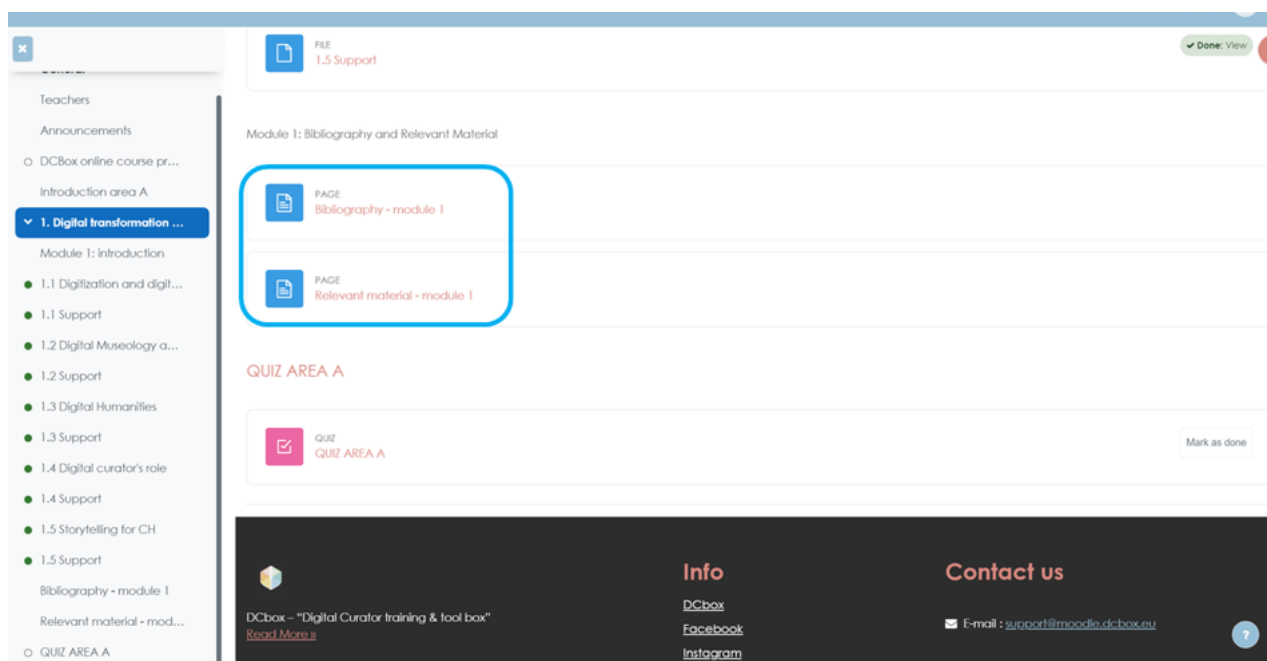


Fig. 4.13 – The section bibliography and relevant material, available for each module

QUALIFIED USERS: ACTIVITIES

As mentioned above, in some modules, **qualified users** will find practical activities designed to learn new skills with simple assignments. Those activities are not mandatory, and their submissions were supported and reviewed by **“Tutors”** who are DCbox team members specialised in the topics of the exercise. The activity is generally structured with a main PDF file, containing the tutorial and some extra files to complete the task. Once submitted, the tutor corrects the activity and gives feedback on the outcome, regarding the competence of the student or the matter to improve (see Fig. 4.14).

QUIZZES: MODULE QUIZZES AND AREA QUIZZES

To proceed with the following areas, each learner needs to complete a resume quiz. The quizzes are different in the case of qualified students or self-enrolled; in particular, qualified students have to complete one quiz per each module (eight in total), while self-enrolled students will find just one quiz at the end of each area with a selection of questions regarding the covered topics. Quiz completion is mandatory for each student in order to proceed with the course, as the area-key will be unlocked only if all mandatory tasks are completed. This is the only way that users can continue with their learning path. (see Fig. 4.15)

CERTIFICATION OF ACCOMPLISHMENT

In Area D, learners unlock also a “Certificate of Accomplishment”, one of the documents that states the completion of the course with a 2 ECTS value, a more robust certification can be obtained at the same stage with the Open Badge System (see “Chapter 4.4” on page 104).

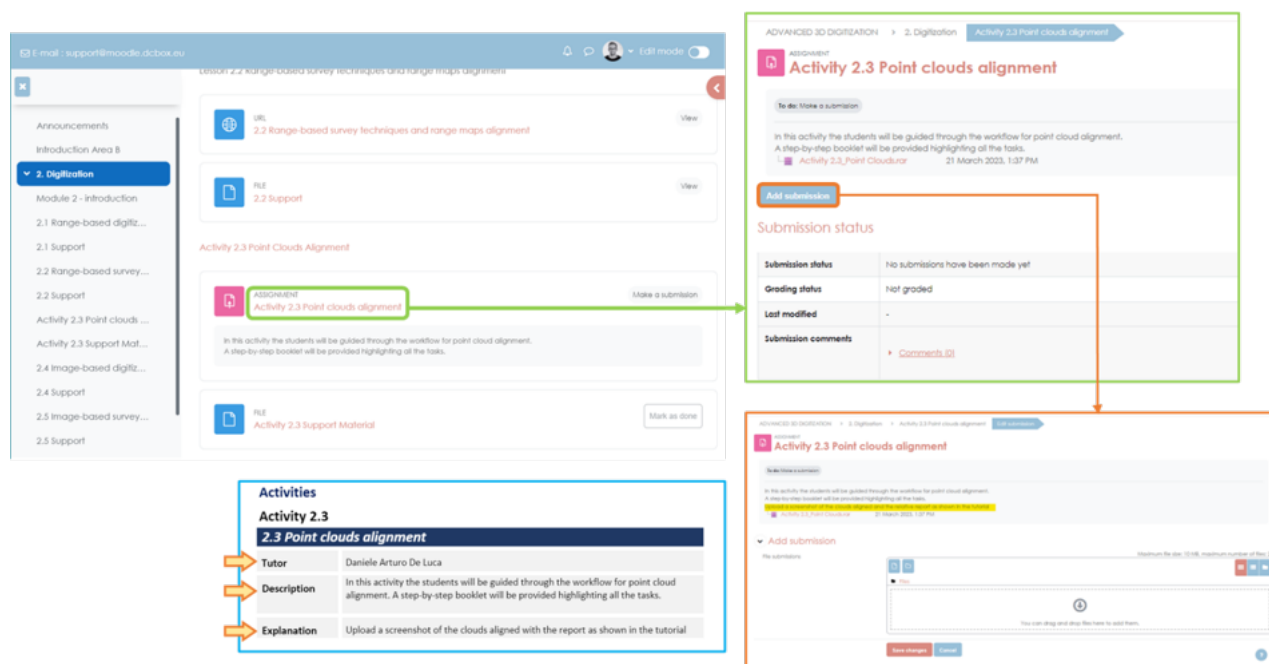


Fig. 4.14 - The section activity, available for some module and when the course is tutored

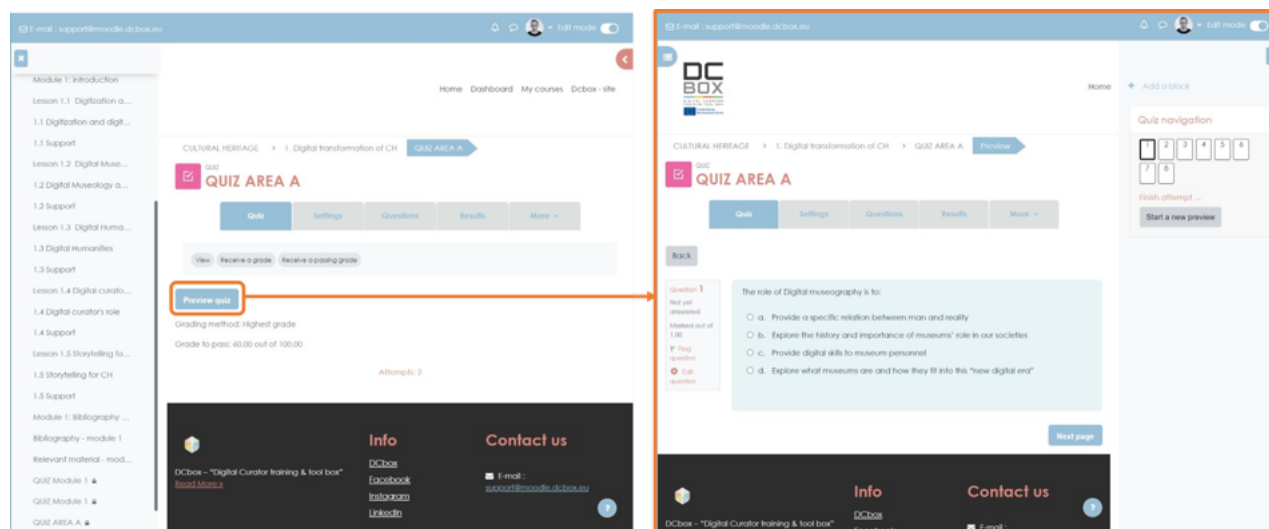


Fig. 4.15 - The section of the quizzes and the interface of each question

VR Module

The last section of the DCbox Learning platform is represented by the VR Module. This section can only be modified by specific users who requested access or were enrolled by the managers. Through the **VR Module**, students can create their own virtual experiences within a **collaborative and easy-to-use platform** within the online DCbox platform.

They can work together in the same environment to build their **personal tours** without the need for specific programming skills.

Some of the possible actions are:

- Add 360° scenes
- Navigate between scenes
- Connect scenes
- Add interactions
- Text about the scene
- Video
- Image of the details

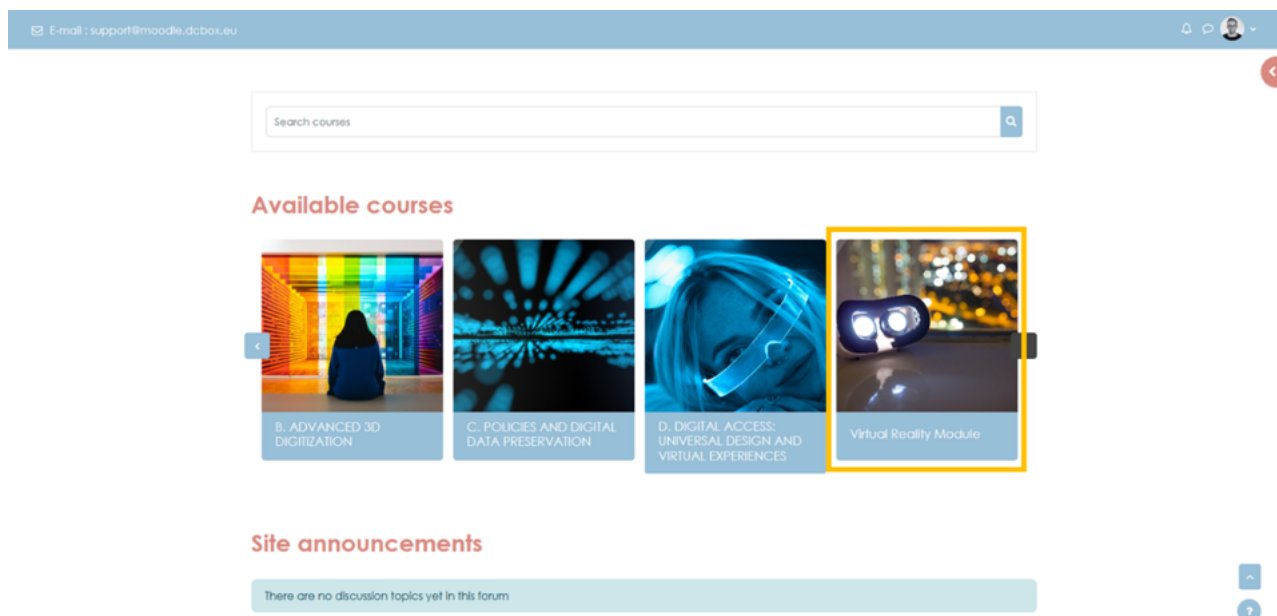


Fig. 4.16 - The MOOC home page with the possibility to access to the VR module

The VR Experiences are displayed with the 'H5P' icon and can be accessed by clicking on the name. Modifying permission and visibilities can be set up for each working group and account.

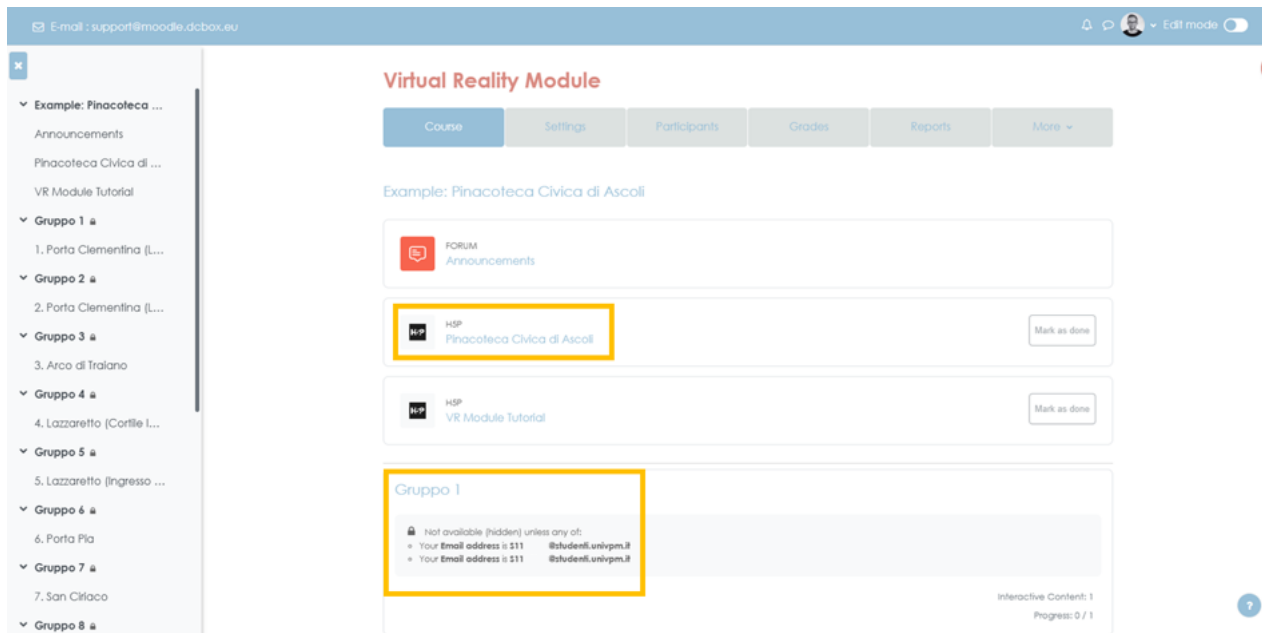


Fig. 4.17 - The VR Module section

THE VIEWER SECTION

In the tab **"Interactive Content"**, users can navigate through the experience, moving between scenes and interacting with the content. Here it is possible to explore the tour and view the final version of the experience.

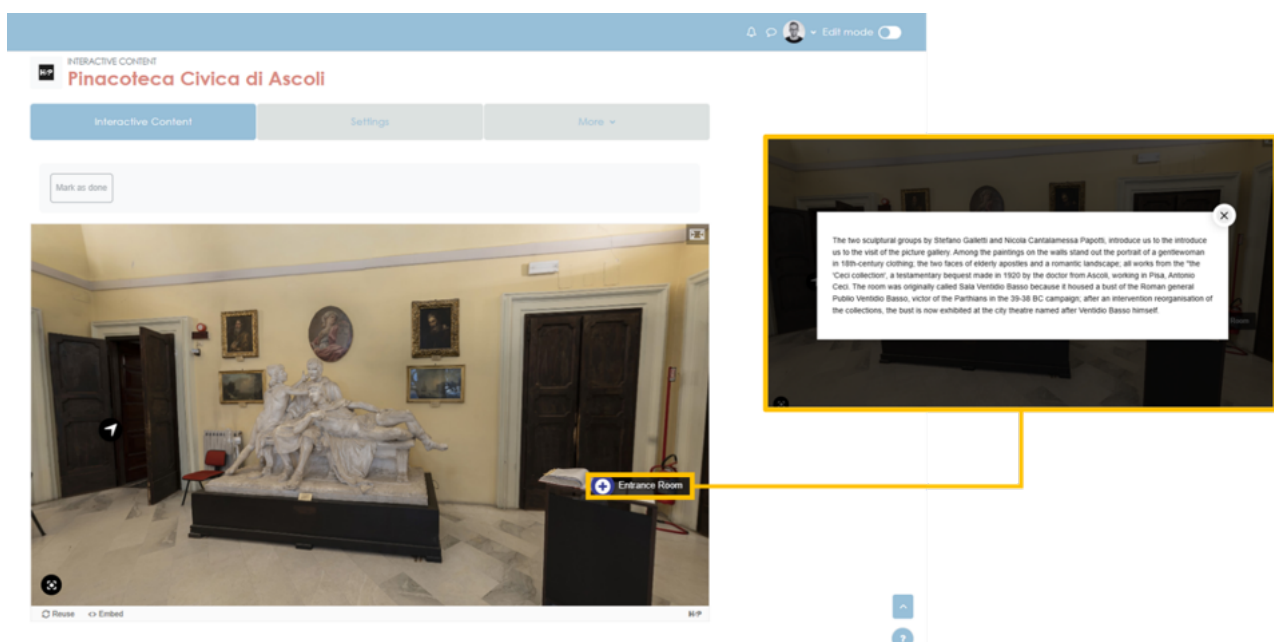


Fig. 4.18 - The viewer section of the VR module: the already prepared tour is visible

THE SETTINGS SECTION

In the **"Settings"** tab, users can modify the content of the experience, adding descriptions and other content, and directly managing scenes and media embedded into the final product.

All those tours can be easily exported in h5p format and embedded into external websites which support this data file format, to see the content without the need to enter the platform.

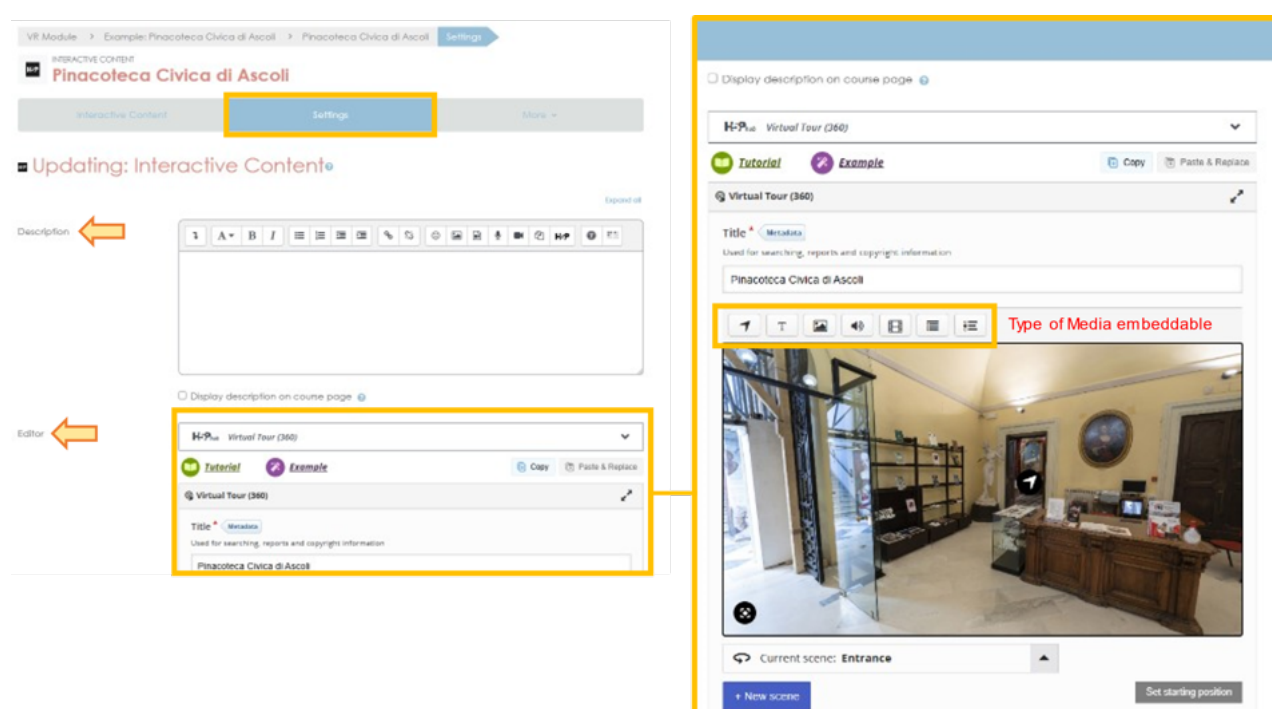


Fig.4.19 - The settings section of the VR module: some tabs for the virtual tour building up are shown

VR EXPERIENCES SHOWCASE

Here are some examples of students' work done using the VR Module on the platform: in this case it was exploited in a learning experience in which learners collaborated to join their own drawing with the rest of team members' work (see Fig. 4.20).

GUEST ACCESS

The section students' works is the only section that can be viewed by a guest visitor (see Fig. 4.21).

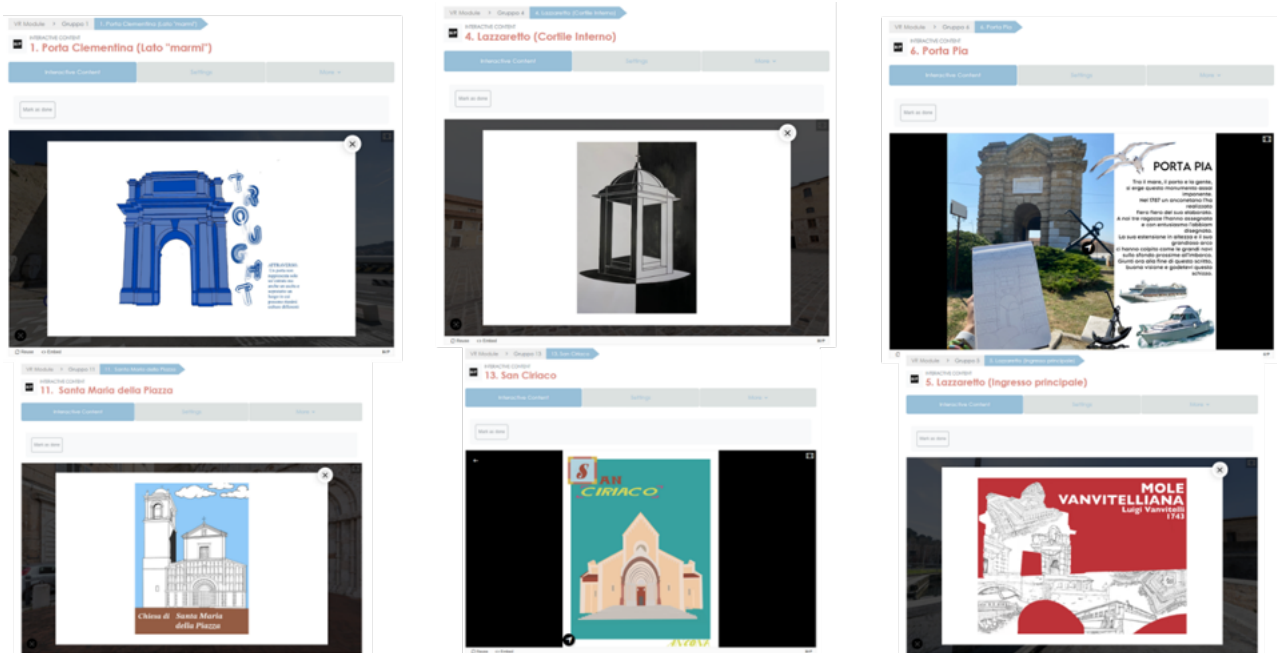


Fig.4.20 - Gallery of learners' works

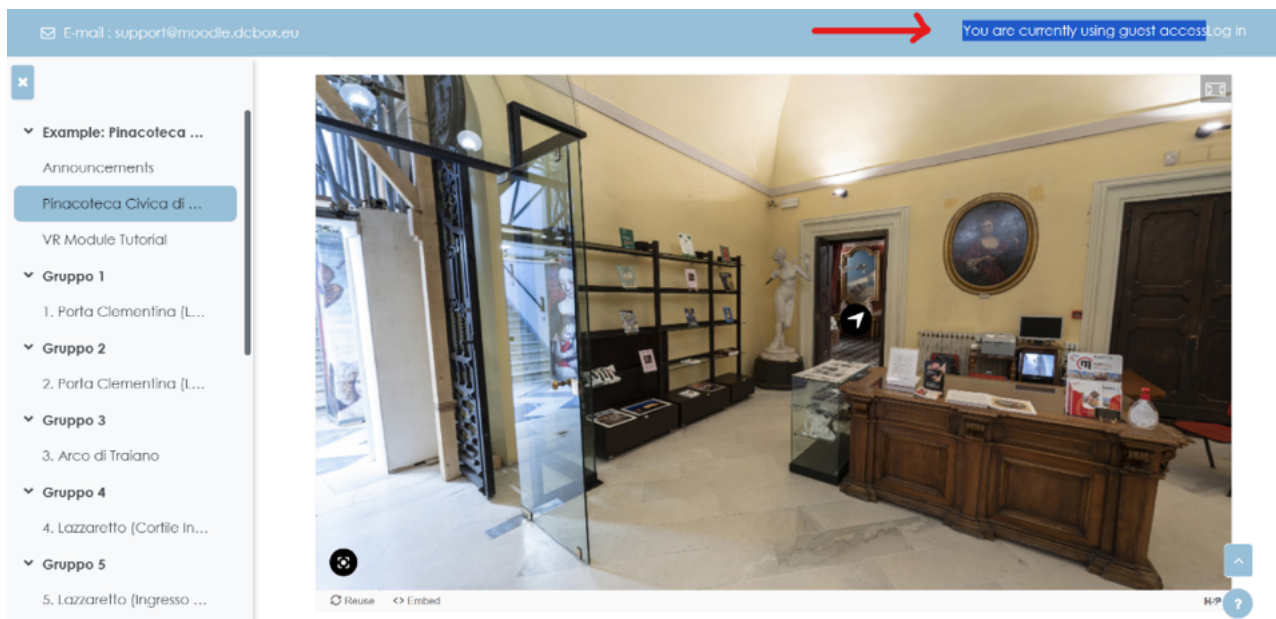


Fig. 4.21 - The visualisation of the VR module by a guest visitor

Monitoring & Awarding – Open Badge System

Chapter 4.4

Olesya Ivanova

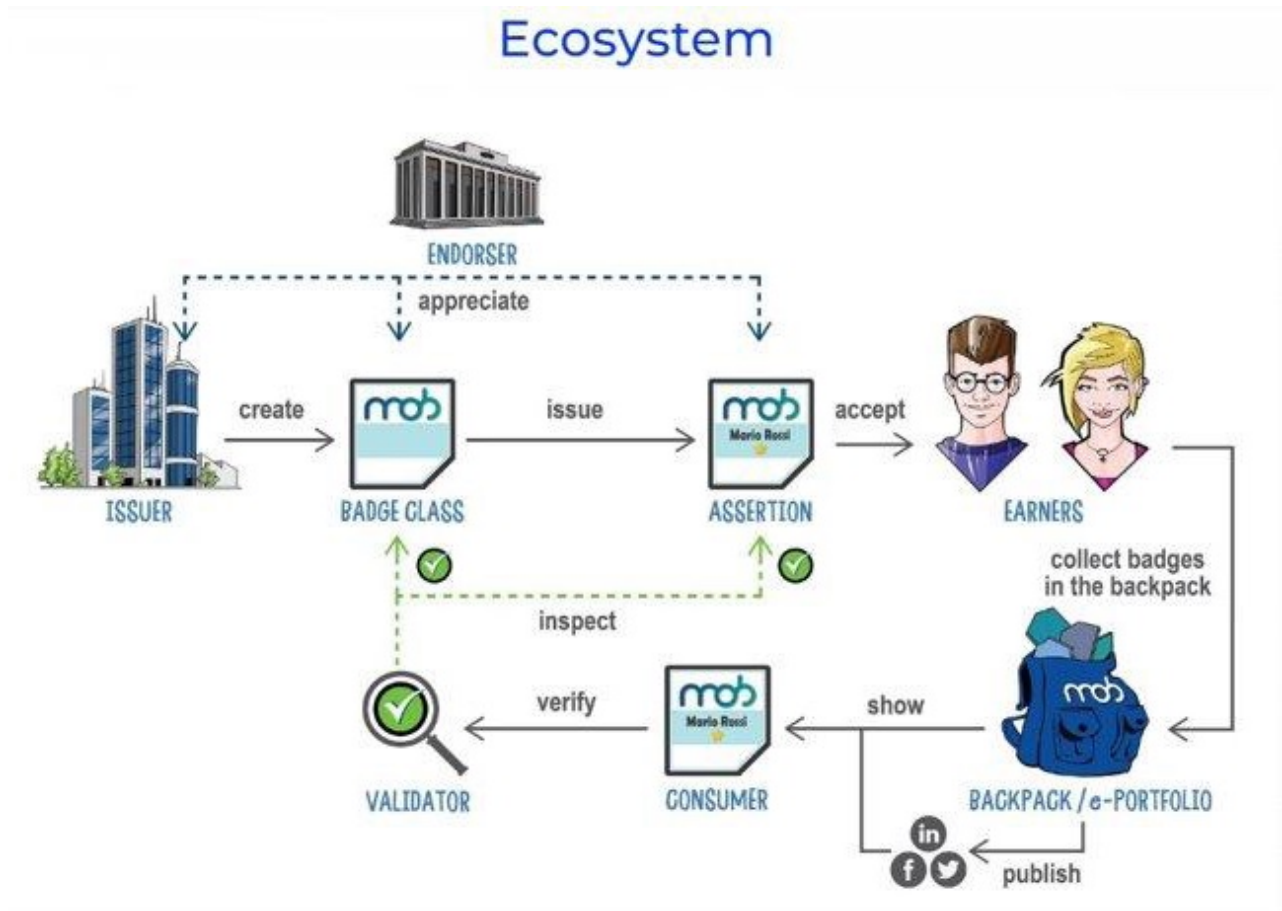
One of the issues with the default Moodle certification is that the effective value cannot be validated through an external system and could easily be faked with some image editing software. That's the reason why the DCbox team has opted also for an alternative "Open Badge" attribution system.

Besides the standard certificate, the platform has an **automatic system** able to create **traceable documents** assigned to students after completing certain achievements.

Open Badges are a type of digital accreditation, often displayed as badges, containing metadata about the achievement or competence that the badge represents, making the achievements easily visible to potential employers and colleagues, and by collecting them in a 'Backpack', a digital storage bag with all the certificates obtained.

There are three actors in the Open Badge environment:

- The **issuer**: This is the entity that defines what you must do to earn that badge (DCbox)
- The **earner**: This is the person that needs to attend the training pass the test, then go through the simulator training and line training, and finally pass the check ride (**students**)
- The **displayer**: This is not a real person, but a computer (cloud-based or workstation) program that will display the page in the desired places such as the Learning Management System (**Moodle**).



The two main badges are included in the Platform:

- A Standard Badge (on the left below), assigned to students (qualified and self-enrolled) when completing all the lectures and the quizzes of each area.
- A Full Badge (on the right below), assigned only to qualified students who completed all the previous requirements and also all the activities of the four areas.

Fig.4.22 - The main actors in the Open Badge environment



Open Badges is not a specific product or platform, but a type of digital badge that is verifiable, portable, and packed with information about skills and achievements. This kind of certification has a higher value and allows students to embed it with other certifications obtained with the same Open Badge system.

Fig. 4.23 – The 2 images prepared to be linked to the Open Badge for Standard and Full Badge

As an **earner**, it is possible

- Demonstrate skills and accomplishments, often by submitting evidence, by earning Open Badges.
- Claim Open Badges when issued to you.
- Collect your Open Badges in a portfolio or backpack to tell your story.
- Share your Open Badges on social media and with your community.

As an **issuer**, it is possible

- Break learning down into small chunks.
- Recognise learning based on proficiency.
- Award Open Badges for completion of micro-credentials

OB STRUCTURE AND ACHIEVEMENT

The structure of DCbox's Open Badge system is as follows: for each completed Area, the student earns the Standard Badge; in the event that the student has also completed the activities (exercises more complex than quizzes), they also receive the Full Badge.

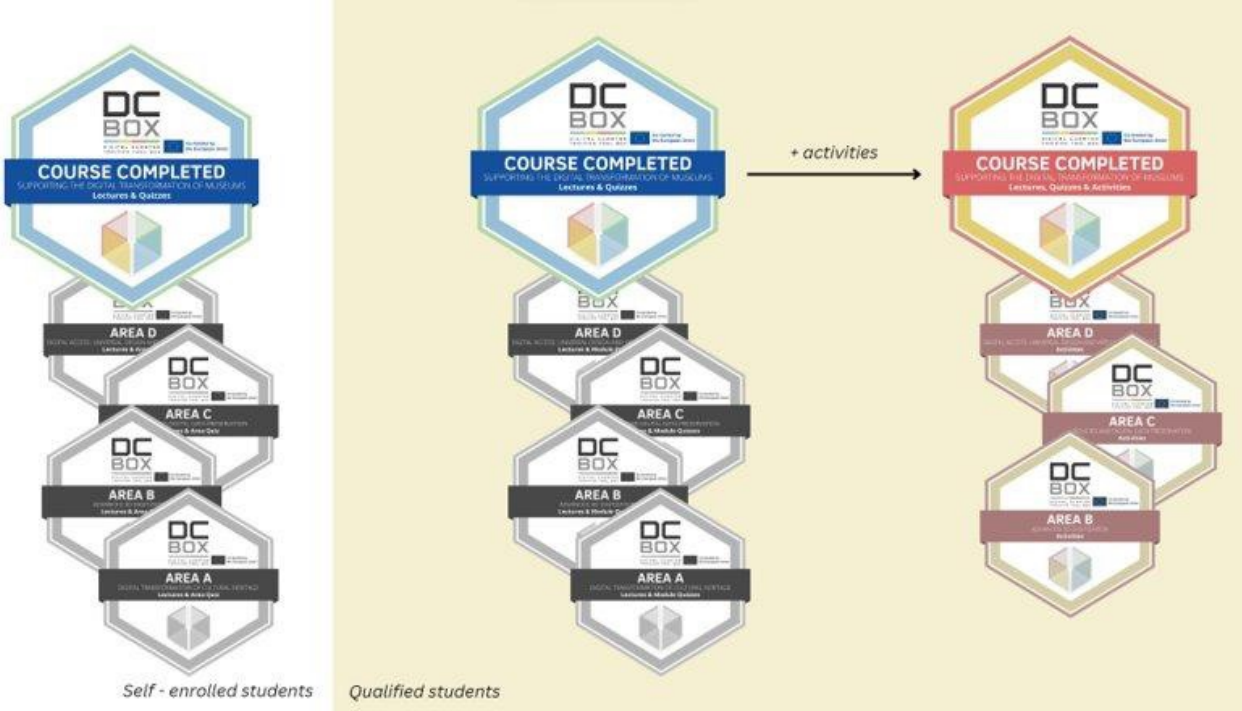


Fig. 4.24 - The structure of Open Badges (Standard and Full Badge)

For every badge obtained, the learner receives an email notification. They can also find their earned badges in their personal area.

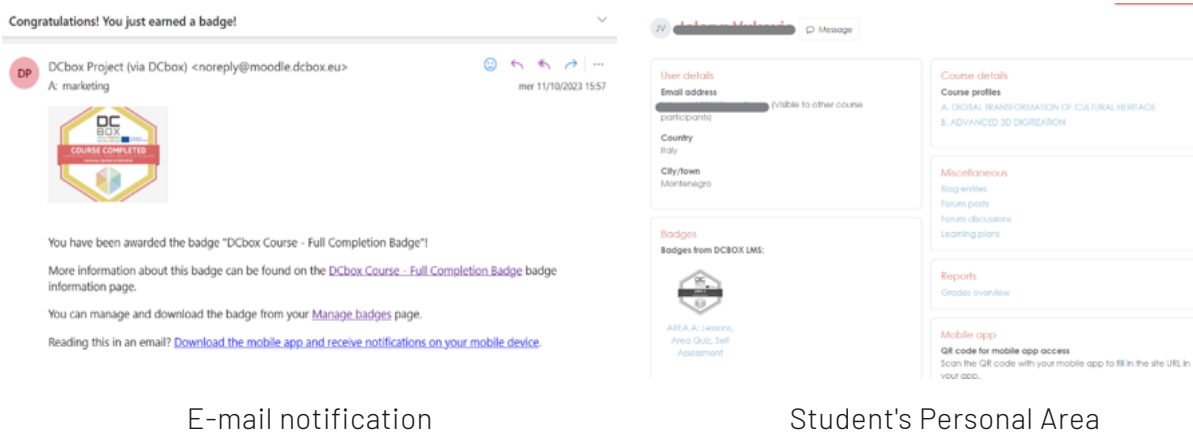


Fig. 4.25 - The badge is released via email to the learner and available also in the personal area

Students can see the criteria of the badge release when they achieve badges:

Preferences > Manage badges AREA A: Lessons, Area Quiz, Self Assessment

AREA A: Lessons, Area Quiz, Self Assessment



Download

AREA A: Lessons, Area Quiz, Self Assessment

Awarded to J. [REDACTED]

Issued 13 November 2023, 12:06 AM

Issued by DCbox Project

"The owner achieved the ""AREA A: Lessons, Area Quiz, Self Assessment"" badge by successfully completing Area A, which themes are: Digitization and digitalization Digital Museology and Museography Digital Humanities Digital curator's role Storytelling for CH This badge is a mandatory component of the course's main badge set. Each area badge is a required element, and upon earning all of them, the student achieves the main course badge, signifying successful completion."

Criteria

- The following competencies have to be completed:

1. Digital transformation of CH Area A
A. DIGITAL TRANSFORMATION OF CULTURAL HERITAGE - Competency
Path: A. DIGITAL TRANSFORMATION OF CULTURAL HERITAGE /

[More details](#)

Fig. 4.26 - The badge allows to certify the obtained competences

OB REDEEM ON EXTERNAL PLATFORMS

The Badges obtained can be **transferred to external platforms** such as Badger (<https://badgr.com/>), to manage the certificates and to link them to other websites (e.g. LinkedIn). When achieved, there are two ways to add a badge to the backpack:

- Connect the backpack to Moodle;
- Download the badge (from Moodle or email notification) and add it to the backpack.

In the Backpack the learners can do multiple actions with their certificates, such as sharing the badge, download the badge, print as a certificate, remove the badge from backpack, view the public page of the badge, and view the badge's JSON file.

For enhanced security, the learner is identified by the backpack through his/her email. To receive the badge in their backpack, it is mandatory to create a backpack account using the same email as the Moodle profile. In case the two emails do not match, the backpack generates an error as shown below.

Email Moodle = Email Backpack (<https://badgr.com/>)

Newly Added Badges



AREA A: Lessons, Module Quizzes, Self Assessment

Failed to import into your backpack. The given badge does not appear to have been awarded to any of your verified email addresses.

Error UUID: dcff16f1-cbbe-4e07-ac3c-08b96504a6df

Remove

This does not affect sharing the badges on social media. In fact, it is possible to share the badge, for example, on LinkedIn even if the student registered on LinkedIn with a different email from both Moodle and the backpack.

Backpack settings

▼ Backpack connection

Backpack provider:

Status: Not connected

Email address:

Password:

Press enter to save changes

Connect to backpack

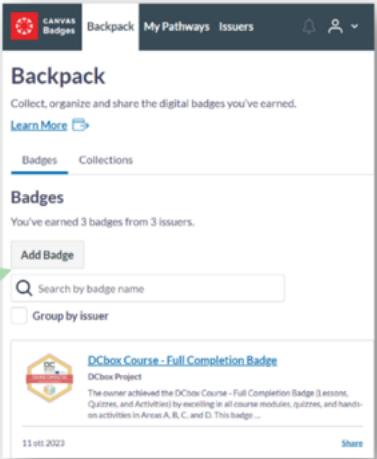
1. Connect the backpack to your Moodle



Download

Add to backpack

2. Download your badge and add it to your backpack.



Add license or certification

* Indicates required

Name*
DCbox Course - Full Completion Badge

Issuing organization*
Canvas Credentials (Badgr)

Issue date
October 2023

Expiration date
Month Year

Credential ID
6526a9cbf0a06743fd84ddce

Credential URL
https://moodle.dcbbox.eu/badges/assertion.php?b=fff6430fea45ff1c89da5012dc19f3a7ea419e11&obversion

Save

AREA A: Lessons, Module Quizzes, Self Assessment

DCbox Project

"The owner achieved the "AREA A: Lessons, Module Quizzes, Self Assessment" badge by successfully completing Area A, which themes are: Digitization and digitalization Digital Museology and Museogra..."

11 ott 2023

Share

Share Badge

Link Social HTML

☒ Show email address: marketing@sinerzia.it

Share to profile

Add to profile

Share to feed

Home
 My Network
 Jobs
 Messaging

← Licenses & certifications

DCbox Course - Full Completion Badge
 Canvas Credentials (Badgr)
 Issued Oct 2023
 Credential ID 6526a9cbf0a06743fd84ddce

Show credential



Learners' view on the DCbox course

Chapter 4.5

In this chapter, we present the feedback received by students on the DCbox MOOC. These are based on the questionnaires administered before and after the completion of the DCbox MOOC.

28 students in total participated in the MOOC and 19 of them completed all the foreseen modules and replied to both questionnaires: in this case the analysis are carried out only on the students that piloted the course.

The completion rate of the students has suffered different issues, such as students graduating during the course or moving to other universities, this with the natural abandoning rate due to physiological reasons, dropped the active students to the final number.

Data elaboration is therefore based on this sample of 19 students having completed both questionnaires. Although we are aware of the fact that the results of such an elaboration are not statistically significant, we value the qualitative input that the feedback gave to the DCbox consortium and the suggestions and recommendations received for future possible improvements of the course by organisations and institutions willing to re-use and adapt our MOOC for their specific purposes and needs in the field of Digital Curation.

After providing an overview of the sample features, this chapter focuses on the perceived impact of the course (by students themselves) on skills improvement and the general feedback received about the course structure and organisation, the quality of the modules and the assessment approach and tools adopted.

LEARNER'S PROFILE

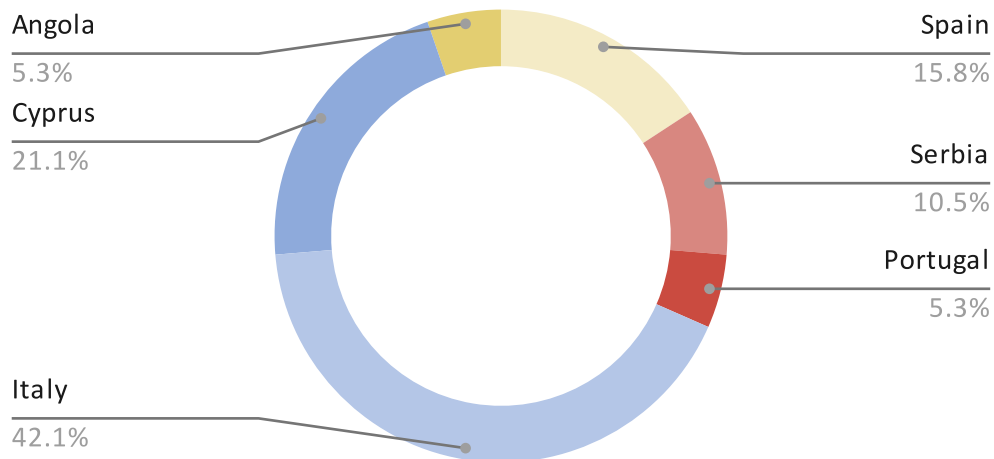
COUNTRY

As shown below, most respondents come from Italy and Cyprus, followed by Serbia and Portugal. Also, an Angolan student replied to the survey, being based in one of the partner universities of DCbox.

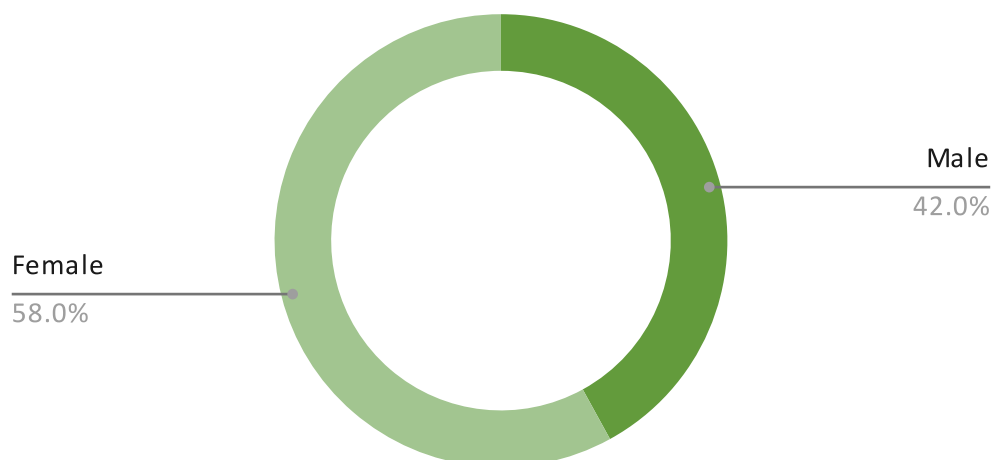
GENDER

The sample has an almost equal distribution in terms of gender, with 58% of females and 42% of males.

Country



Gender



SKILLS ASSESSMENT (PRE VS POST-COURSE)

In the pre and post-course questionnaires, respondents were asked to self-assess their level of awareness of a set of knowledge and skills addressed in the course and identified as key skills for Digital Curation. In particular, the following questions were asked:

3D DIGITISATION: DIGITAL ACCESS – UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES

3D Digitisation

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

Most of the respondents ranged between a “poor” and average awareness level before taking the course, whereas the level increased to average/good after taking the course.

DIGITAL ACCESS: UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES

Digital Access – Universal Design and Virtual Experience

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

Most of the respondents replied they had a poor/very poor awareness of the contents of this area before the course. After taking the course, all respondents showed a more positive perception, ranging between average and excellent.

DIGITAL DATA PRESERVATION

Digital Data Preservation

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

Most of the respondents replied they had a poor/very poor awareness of this area before participating in the course. After taking the course, most respondents but one showed a much more positive perception, ranging between average and excellent.

DIGITAL TRANSFORMATION AND CULTURAL HERITAGE

Digital Transformation and Cultural Heritage

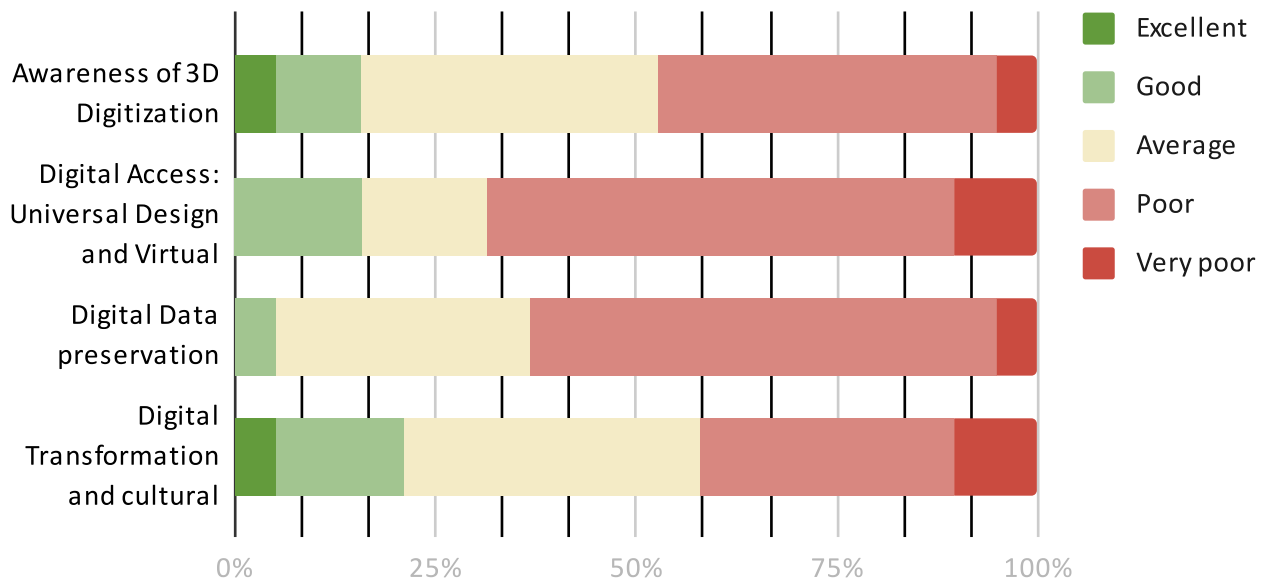
PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

The pre-course awareness level of the concept Digital Transformation and Cultural Heritage was quite evenly distributed across all levels (ranging from excellent to very poor). Post-course self-assessment positions awareness levels on the positive side of the graph, with a significant concentration in the “good” awareness level.

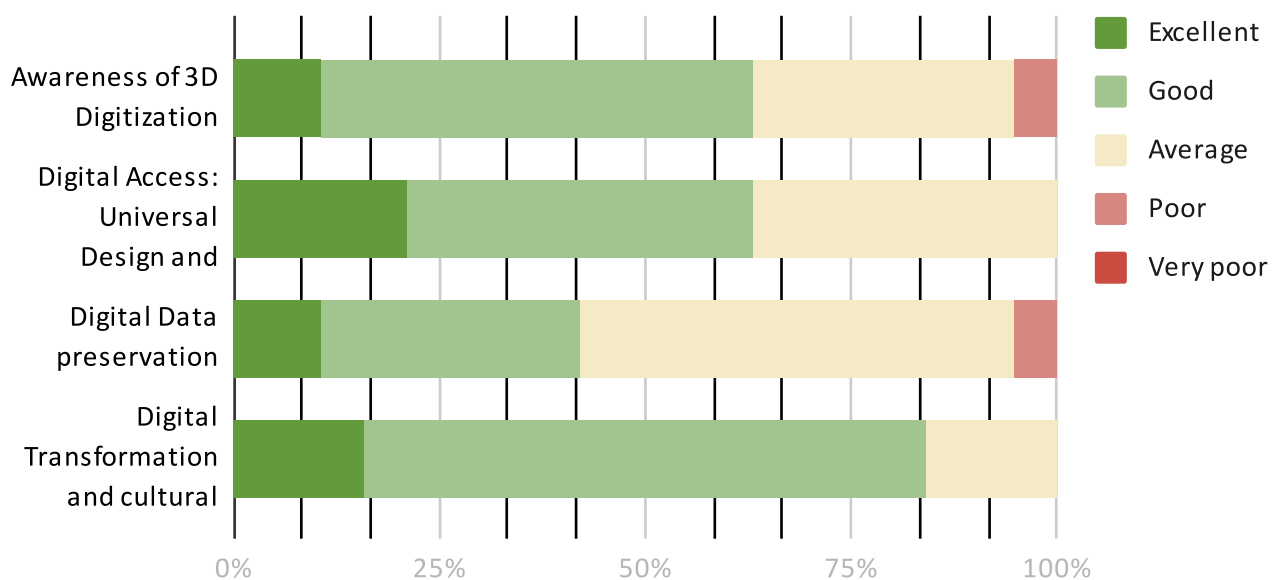
Awareness level of the core concepts addressed in the DCbox online course

PRE-COURSE



Awareness level of the core concepts addressed in the DCbox online course

POST-COURSE



AWARENESS EXTENDED REALITY TECHNOLOGIES

I am aware of the different Extended Reality (XR) technologies employed in the Cultural Heritage sector

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

The replies by respondents suggest that the awareness on Extended reality technologies was already at a quite good level before the course and therefore the perceived improvement after the course is not so strong, with one respondent even disagreeing on the fact that the course supported increased awareness in this field.

AWARENESS OF THE INTERNATIONAL CONVENTIONS AND THE EUROPEAN AND NATIONAL LAWS RELATED TO DIGITAL CULTURAL HERITAGE

I am aware of the International Conventions and the European and national laws related to Digital Cultural Heritage

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

In this area, the course has contributed to increasing the level of awareness of participants, as depicted in the graph below, a shift from the negative/neutral to the positive perception of self-improvement is clearly visible.

AWARENESS OF DIGITAL CURATOR SKILLS

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course: **I am aware of the main digital curators' skills**

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course? **I am aware of the main digital curators' skills**

Whereas the pre-course self-assessment provides a quite fragmented view on the levels of respondents' awareness on the main digital curators' skills, distribution after the course is much more concentrated on the positive side of the graph (agree/strongly agree), suggesting a good impact of the course on respondents perception of their skills' improvement in this area.

AWARENESS OPEN FORMATS FOR DIGITAL CULTURAL HERITAGE

I am aware of the Open Data Formats that can be used for Digital Cultural Heritage

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

The sufficient effectiveness of the course in increasing awareness of the Open data formats that can be used for Digital Cultural Heritage is confirmed by the feedback: half of the respondents moved from "disagree" to "agree" whereas the rest of the respondents were almost evenly before and after taking the course.

ABILITY TO COLLECT AND PROCESS RELEVANT DATA TO DELIVER A HIGH-RESOLUTION ACCURATE 3D MODEL

I can collect and process relevant data to deliver a high-resolution accurate 3D model

PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

The distribution of self-assessment levels before and after taking the course appears quite even as far as the ability to collect and process data to deliver a high-resolution accurate 3D model is concerned, suggesting that respondents already had a good level of development of this competency before taking the course.

ABILITY TO DESCRIBE WHAT DIGITISATION OF CULTURAL HERITAGE IS

I can easily describe what Digitisation of Cultural Heritage is

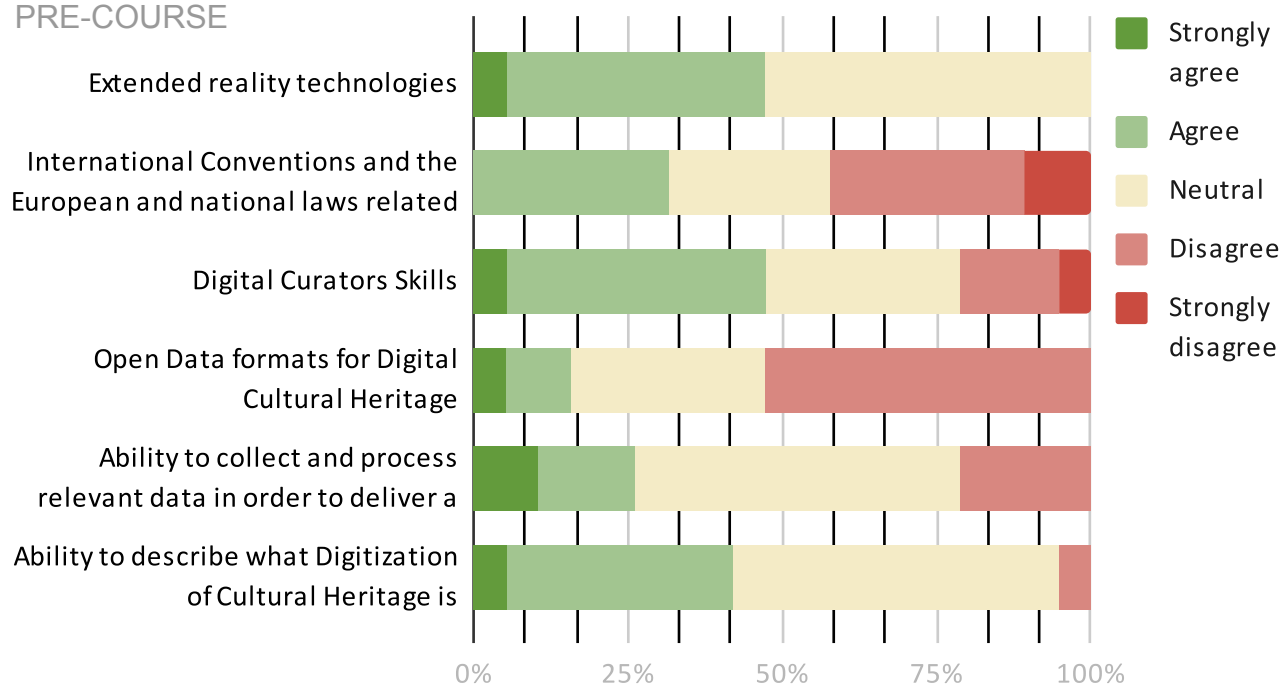
PRE-COURSE: Please self-assess your awareness level of the core concepts that will be addressed in the DCbox online course.

POST-COURSE: After your experience with the DCbox online course, could you please self-assess your awareness level of the core concepts of the course?

Results suggest that through the course respondents learned how to (better) define and describe the Digitisation of Cultural Heritage, with a concentration of replies included in the range "agree" to "strongly agree" for the post-course assessment.

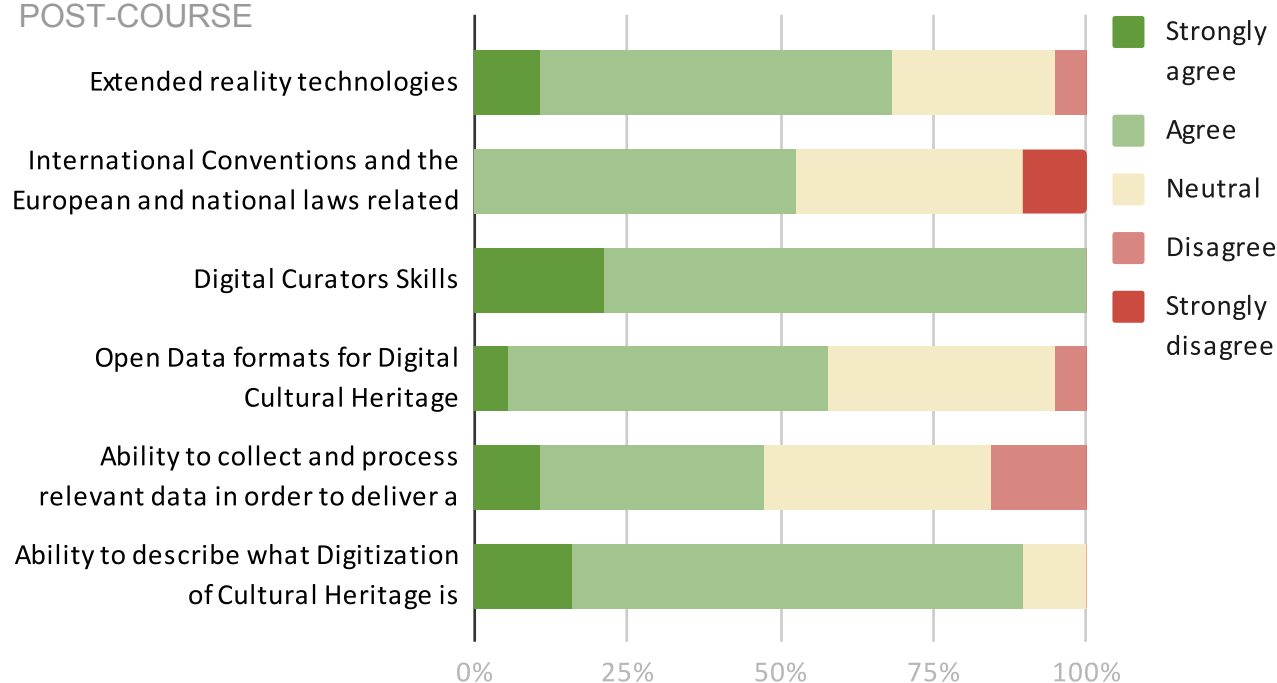
Awareness level of the core concepts addressed in the DCbox online course

PRE-COURSE



Knowledge and competences related digital cultural heritage (statements)

POST-COURSE



In the post-assessment questionnaire, additional questions were asked concerning the acquired skills thanks to the course. Focus was set on:

- i. awareness of AI technologies for cultural heritage;
- ii. ability to develop a simple AR application;
- iii. ability to use different digital tools to enhance communication between cultural heritage and the public.

The results of the self-assessment by respondents are shown in the 3 graphical representations below and confirm the positive impact of the course in enhancing these skills.

AWARENESS OF AI TECHNOLOGIES FOR CULTURAL HERITAGE

Most respondents agree with the fact that their awareness of AI technologies for Cultural Heritage and their capacity to develop AR applications has increased.

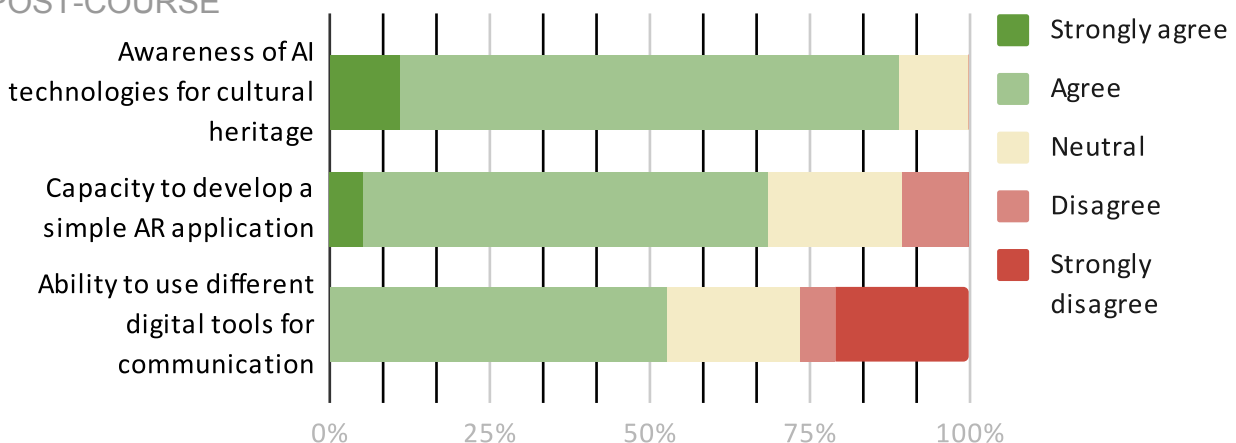
CAPACITY TO DEVELOP SIMPLE AR APPLICATIONS

As concerns the ability to use different digital tools to facilitate communication with the public, the impact looks less positive, with 5 respondents disagreeing or even strongly disagreeing and 4 keeping a neutral position.

ABILITY TO USE DIFFERENT DIGITAL TOOLS FOR COMMUNICATION

Acquired skills

POST-COURSE



Feedback about MOOC modules

The DCbox MOOC contains the following modules:

Module 1: Digital Transformation and Cultural Heritage

Module 2: 3D Digitisation

Module 3: 3D Modelling and Data Implementation

Module 4: Policies Rules and Licensing

Module 5: Digital Data Preservation

Module 6: Communication

Module 7: Virtualisation

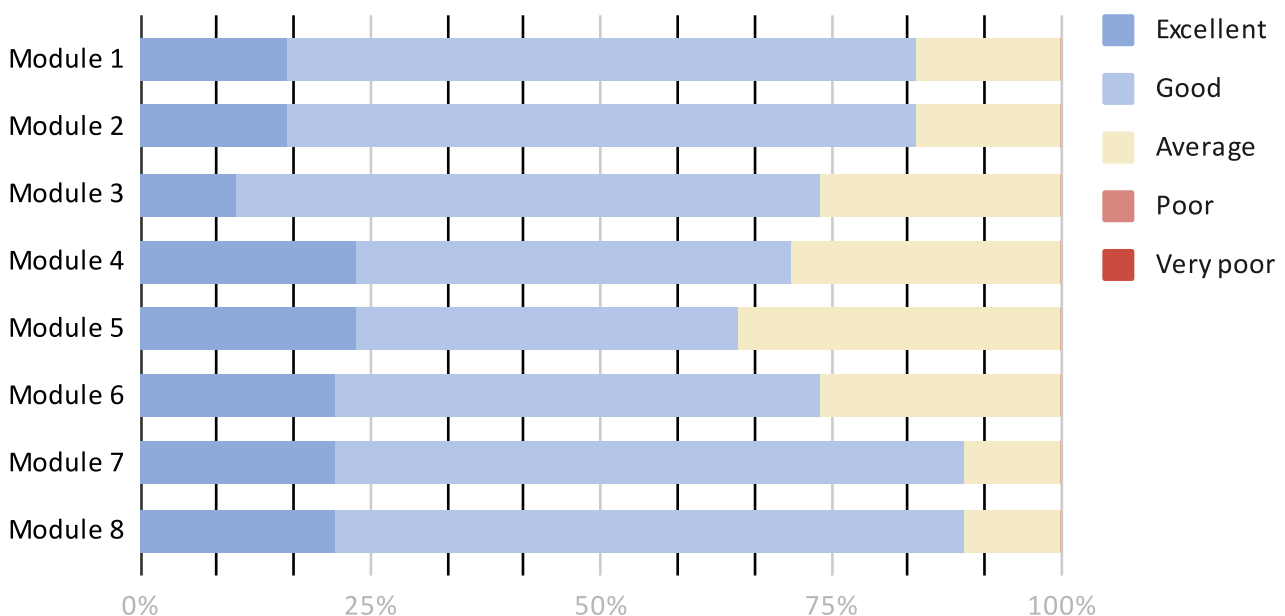
Module 8: New Frontiers in Cultural Heritage

In general, all modules of the MOOC were appreciated by respondents. As shown below though, some modules show room for improvement in terms of the balance of multimedia/text, of the new competencies acquired and of the usefulness of the activities.

All modules seem to be appreciated in terms of balance multimedia/text, with the best performing ones being modules 1, 2, 5, 7 and 8.

Balance Multimedia/text

Feedback about MOOC modules

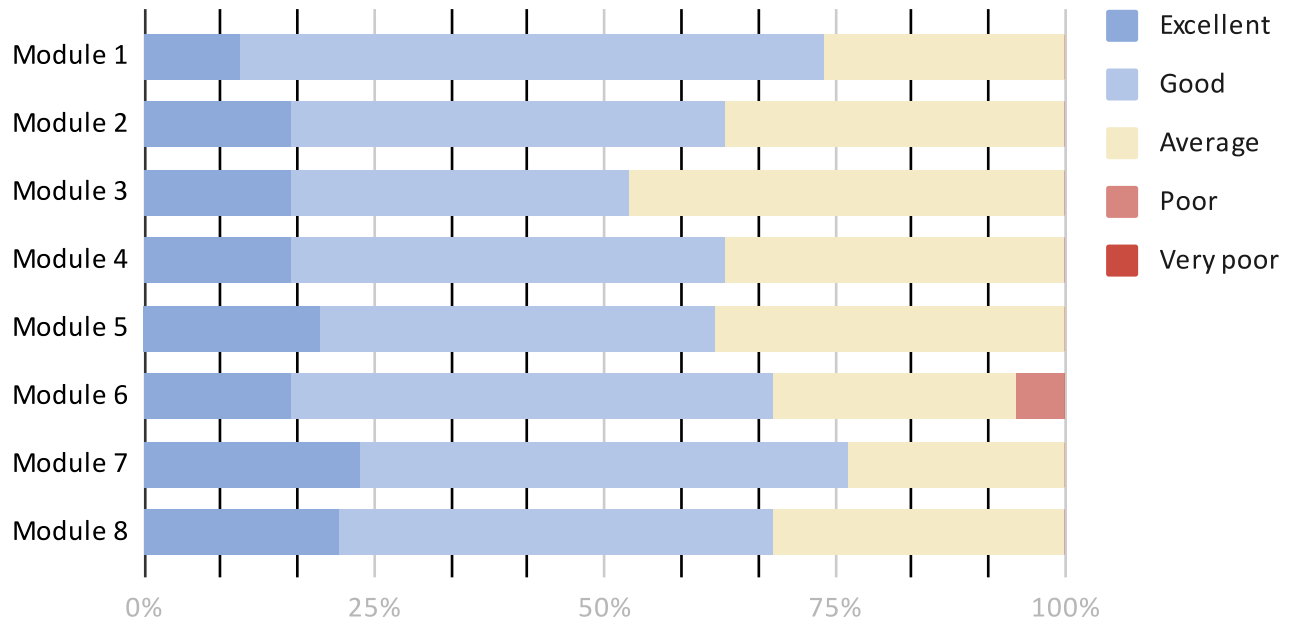


NEW COMPETENCIES ACQUIRED

In terms of new competencies acquired, the best-performing modules appear to be Modules 1 and 5.

New competences acquired

Feedback about MOOC modules

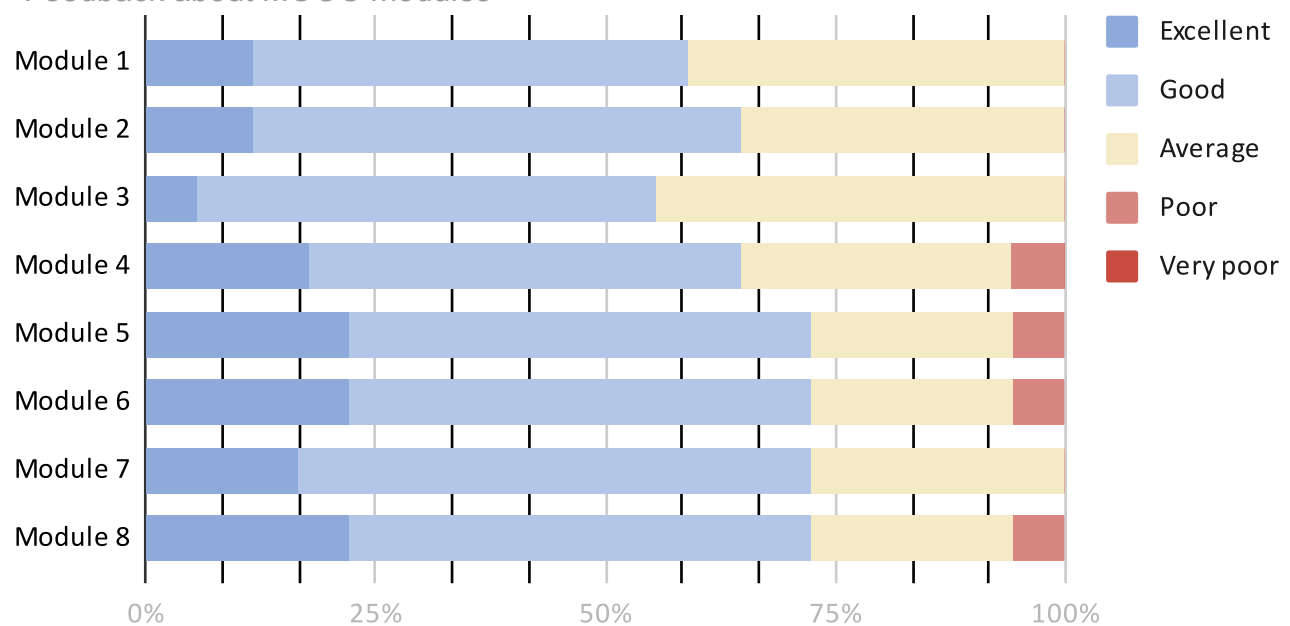


THE USEFULNESS OF THE ACTIVITIES

All modules are judged as useful in terms of the activities carried out within them, with a peak for module 7.

Usefulness of the activities

Feedback about MOOC modules

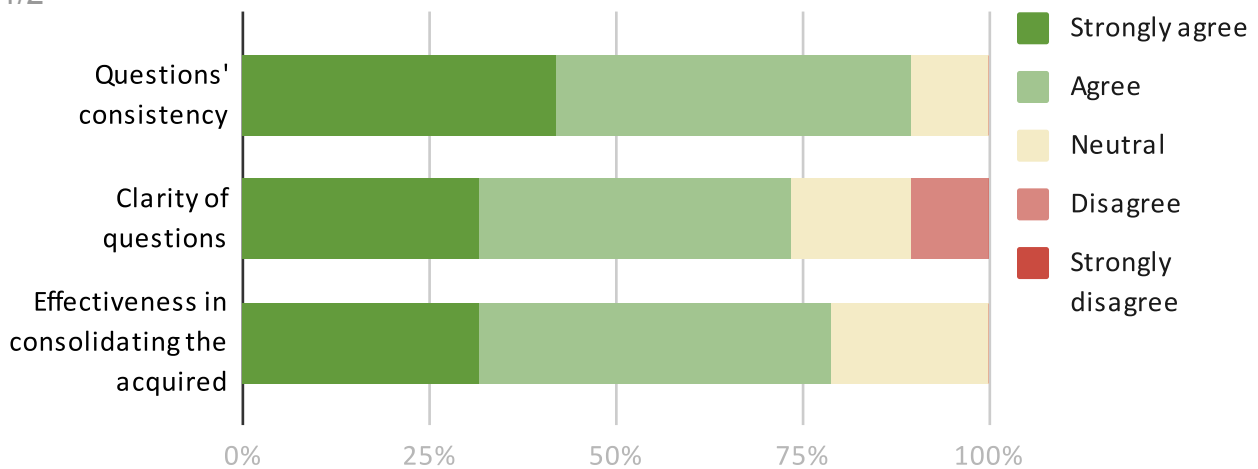


Feedback about the MOOC assessment tools

Part of the post-course questionnaire was dedicated to getting feedback on the quality of the assessment quizzes. Items addressed were: consistency of quizzes with the content of the corresponding modules; clarity of questions; effectiveness in consolidating the acquired knowledge; and effectiveness and length of quizzes.

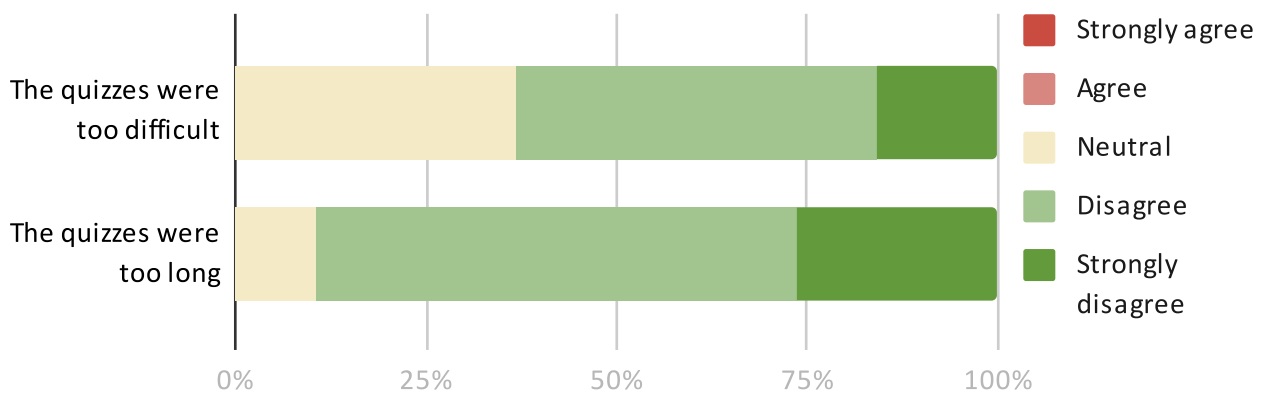
Feedback about the MOOC assessment tools

1/2



Feedback about the MOOC assessment tools

2/2



The following suggestions were provided by respondents to improve the quizzes:

- Carry out assessments at the end of each module and not at the end of the whole course
- Implement a more specific assessment based on the application of the acquired knowledge.
- Revise the language

Overall feedback about the course

One section of the post-course questionnaire was dedicated to the feedback by learners concerning the entire course. Various aspects were addressed, as listed below.

CLARITY ON THE LANGUAGE OF THE COURSE

Most Respondents believe that the course language was fairly clear, and only 2 find it poor.

SATISFACTION WITH COURSE DURATION AND ORGANISATION

55% of respondents are satisfied and 20% are very satisfied with the duration of the course.

95% of respondents are satisfied or even very satisfied with the course organisation.

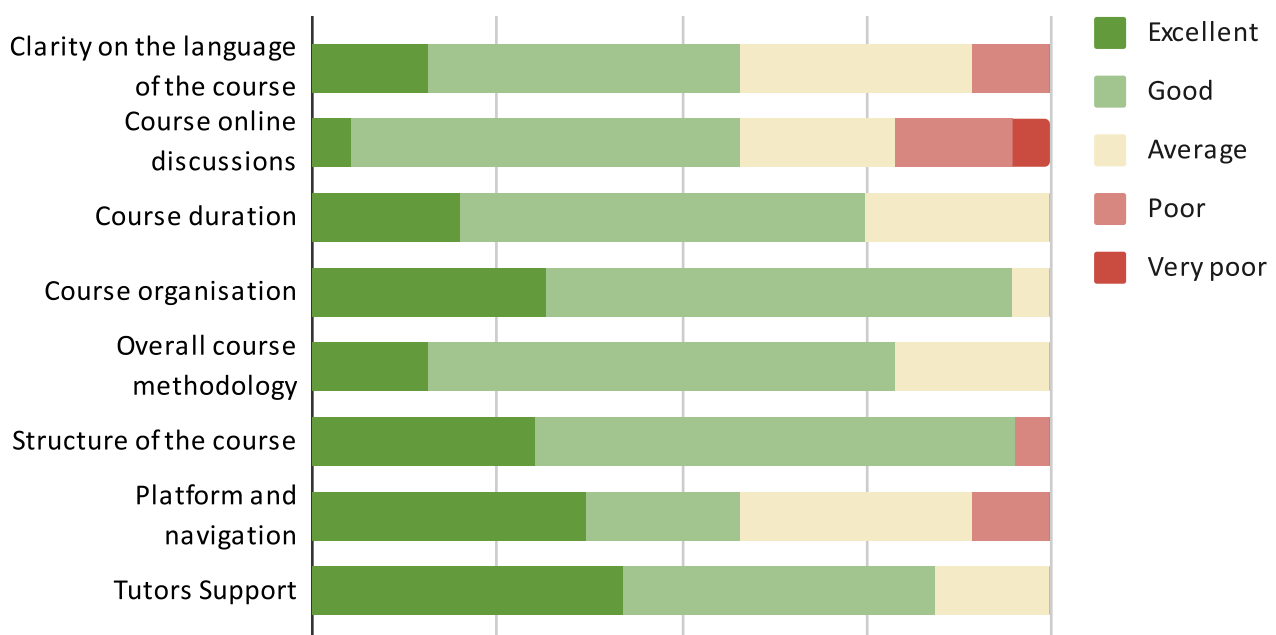
OVERALL COURSE METHODOLOGY AND STRUCTURE

The overall course methodology is appreciated by all respondents: 63% find it good, 16% excellent and 21% average. As concerns the course structure, 95% of respondents find it either good or excellent.

The assessment of the platform and navigation tool looks more distributed across the sample, with more than half of respondents (58%) finding it good or excellent and the rest average (32%) or poor (10%).

Last but not least, the tutors' support was appreciated or even highly appreciated by 84% of respondents, and judged as "average" by the rest of the sample.

Overall feedback about the course



Furthermore, some open questions were posed to respondents:

1. Would you recommend this course to a fellow student or colleague? Why?
2. How would you advise us to improve the course?
3. How do you see yourself using what you have learnt in the future?
4. Do you have a personal reflection on your learning experience you want to share with us?

As concerns **question 1)** respondents replied positively as the course is deemed to be useful to gaining knowledge and skills in the field of Digital Curation. Some of the most significant answers are presented below:

"Yes, it is a good starting point in understanding the digital curatorial field"

"Yes! It is a great overview of the digitalization of heritage and taught some specific, valuable practical skills".

"Yes, I would. it is useful for any cultural heritage expert to have a brief knowledge of the digital cultural heritage".

As concerns **question 2)** on the suggestions for course improvement, these can be grouped as follows:

- Increase the number of practical activities
- Provide clearer instructions (or even videos) for the practical activities and the assignments
- Provide transcripts of the video lectures
- Include callbacks to previous modules

Some quotations from respondents are presented below:

"The course was so well-structured, the only one difficult for me was the explanation of the practical activities. It was clear, but I think some of them require more specific details or a person guiding the process".

"More clarity in instructions, for some of the assignments there were steps skipped and instructions left out which left students trying to infer what to do".

"I think it's a very complete course, an advice can be an exchange with other countries and a real visit to museums that use those kinds of software and digitalisation"

As far as **question 3)** is concerned, one answer summarises the content of the received feedback by respondents:

"Holding great interest in the field of digitising cultural heritage, this course was a great introduction. Besides the acquired knowledge which will be of great aid in my future projects, this course sparked my interest in the topic and provided me with a better understanding and feeling for the actions needed to be taken in the field of cultural heritage".

Indeed, respondents referred to the value-added of the course for their future career either within the university (further studies or research) or outside (mainly in museums).

As regards **question 4)**, most replies confirm that the learning experience was good and interesting.

"This experience has been very useful to know all the possible areas in this work"

"It was a very interesting course, and I will be delving deeper into the topics that were discussed in the future"

"I wish I could've spent more time developing my skills as a part of this course rather than being drawn away to other, less practical academic pursuits".

"This experience reassured me about the relevance of this topic and inspired me to make an impact on a local level".





CHAPTER 5

Living Labs

Immersive Experience

Università Politecnica delle
Marche

141	Luca Bondi
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Digital Library

Universidad de Cordoba

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Table of Prototypes

Mobile Geolocated App

Cyprus Institute

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158	Nicolette Vollero Levy
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University of Niš

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170	Ana Janačković

Auditorium Pedrotti in Pesaro: VR Experience

Prototype

Student: Luca Bondi

Supervisor: Ramona Quattrini, Daniele De Luca (Università Politecnica delle Marche)

Development of a VR headset application to narrate the history of the Auditorium Pedrotti in Pesaro, starting from an HBIM model, implementing historical media and virtual reconstruction. The aim is to expand the use of the 3D model of the building to communicate the tangible and the intangible heritage and to narrate it to the general public. This was achieved creating a VR headset application with interactive contents that guides the visitor through the different phases of the Auditorium, from its construction to the latest renovations and operas performed. The workflow started from the existing HBIM model, imported into Unity, integrating interactions, assets, and historical media. The user experience featured hotspots for exploring archival materials, showcasing the hall's evolution and old ceiling decorations. The application also included a scene model from the opera "Il Viaggio a Reims" by Gae Aulenti. It allowed free exploration, consulting a media gallery of photos and videos, reviving a unique event celebrating the Auditorium's reopening after restoration works.

*Scan to see
the prototype!*



Sant'Ansano multispectral AR: an application for a painting from the Ancona Civic Gallery warehouses

Prototype

Student: Ludovica Leonardi

Supervisor: Paolo Clini, Renato Angeloni (Università Politecnica delle Marche)

The prototype is designed for the organization and use of in deep investigations relevant to the preservation of artworks. It is an augmented reality application tailored for conservation specialists. The case study focuses on the painting Sant'Ansano at the Civic Art Gallery of Ancona. The purpose of this prototype is to offer a solution for archiving and displaying various information related to the painting's conservation status, leveraging the capabilities of a multi-layer 3D model. Additionally, the prototype aims to provide conservation professionals with a tool to view multispectral images and other information about the conservation status directly on the artwork, thanks to augmented reality.

*Scan to see
the prototype!*



Our

Testimonials

Maria Vittoria Carloni, Civic Gallery "F. Podesti", Ancona

KEY COMPETENCES

"The trainee Ludovica Leonardi worked alongside the scientific staff dedicated to educational services and at the same time undertook a period of direct observation of visitors. On the basis of the received indications, she carried out art historical research on the painting and then formulated different cultural contents useful for the insertion in the app for three specific age groups: children, young people and adults. This editorial work proved to be unexpectedly complex and was completed following prolonged discussions with professionals."



CHALLENGES

"The purely humanistic work, in contact with experts in the dissemination of artistic heritage, led the trainee to develop an interest for historical and artistic topics. She expressed also the curiosity to prepare cultural content to different types of visitors. The in-depth study in the field of heritage interpretation for dissemination purposes highlighted the necessary collaboration of different professional skills for the realisation of a quality product."

*Scan to see the
student interview!!*



From MuseumBIM to VR interaction for the Civic Gallery of Ascoli Piceno)

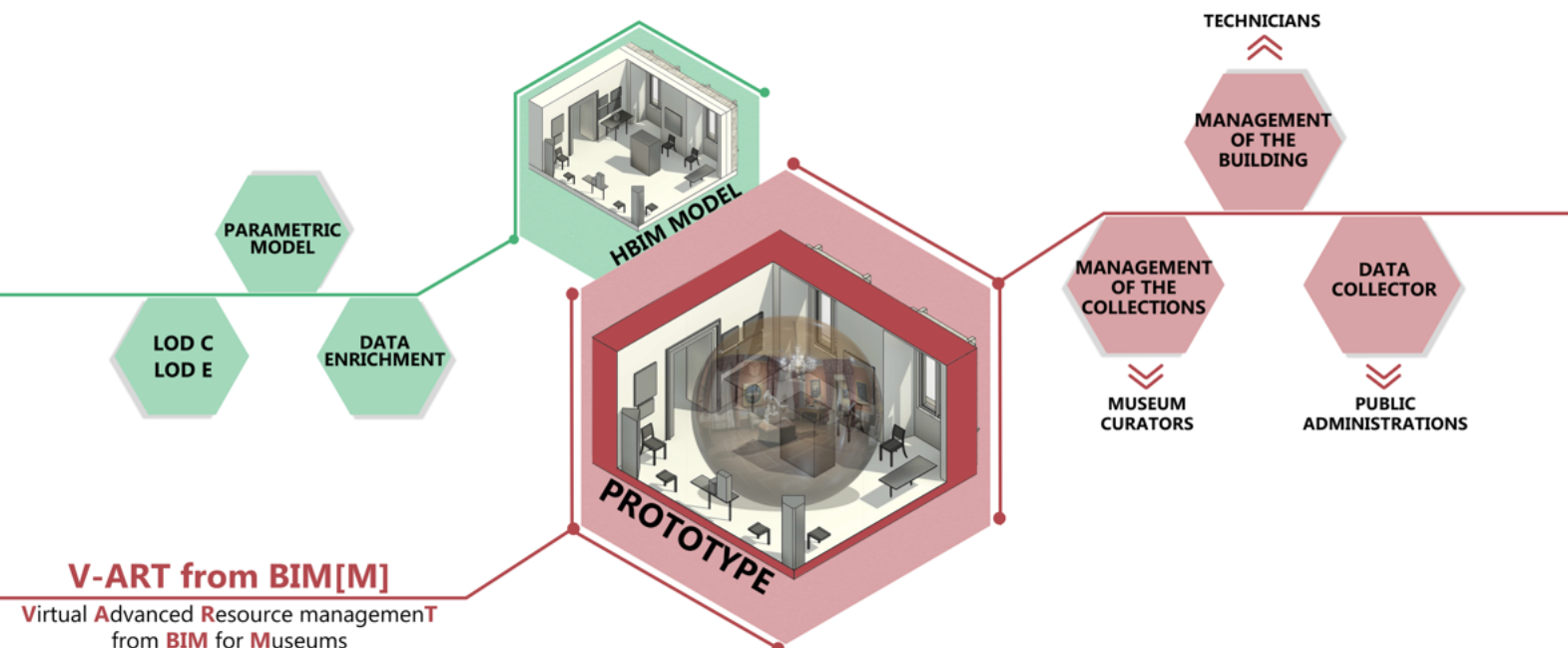
Prototype

Student: Martina Manfroni

Supervisor: Ramona Quattrini, Mirco D'Alessio (Università Politecnica delle Marche)

The project aims to create a prototype of a virtual tour of the Civic Art Gallery of Ascoli Piceno, using a HBIM model integrated with spherical panoramas and other databases. The methodology involves the development of a HBIM model of the first floor of the art gallery, exporting it in IFC format, creating textured spheres with the panoramas, and connecting the BIM with the panoramas in Unity. The result is a desktop application with two interfaces: one for free exploration of the HBIM model and one for viewing the real environment through panoramas. Both interfaces allow to query the elements and obtain the data extracted from the BIM. This prototype offers high visual quality and complete information management for the conservation of the building and collections and can also be implemented with previously created models for ongoing management over time.

Scan to see
the prototype!



Our

Testimonials

Matteo Felicetti, Ascoli Musei

KEY COMPETENCES

"I believe that the key skill Martina acquired during her internship was the ability to transform a request for a humanistic educational content into an agile and efficient working tool. Specifically tasked with developing an app capable of addressing a specific painting technique, Martina was able to grasp the foundational elements of the technique and translate them into concrete examples that could be effectively explained to students using the designed app."



CHALLENGES

"A portion of the internship involved researching technical documentation both in archives and at the Technical Office of the Municipality. The main challenge was the scarcity of information in the archives, leading her to abandon a portion of the internship due to the inability to find accurate information. However, in her interaction with the technical office, she stood out for her competence and precision, providing such accurate guidance that it even facilitated the work of the municipal official overseeing her."

*Scan to see the
student interview!!*



Gigapixel and museum BIM for the Sala Zampetti of the Civic Gallery of Ancona

Prototype

Student: Monica Magi

Supervisor: Paolo Clini, Ramona Quattrini (Università Politecnica delle Marche)

The work carried out as master degree thesis. From the point cloud of the Zampetti Hall in the Civic Art Gallery of Ancona, a scan to BIM process was carried out. A museum BIM model was created as a digital twin incorporating geometric and structural data, linked to the collections in order to improve management and offering a "facility management" tool for the museum functions. The model was made with the parametric software, Autodesk Revit. The starting point to enhance the access to the painted heritage is the gigapixel, which has allowed us to think that the painting could "come to life" and could narrate its essence. The result has been a narrative video, a visual storytelling, of the Pala Gozzi. An animation and a narrative voice explained the painting, accompanying the observer in a new communicative language.

*Scan to see
the prototype!*



The Tomb of the Picenian Queen in Numana: a VR journey to learn about the findings

Prototype

Student: Sofia Diomedi

Supervisor: Paolo Clini, Mirco D'Alessio (Università Politecnica delle Marche)

The application is a virtual reality project: a simulated reality that allows to navigate in the photorealistic environment. It will help to make the museum more accessible to people with motor disabilities, it can be also used to recreate no more existing historical and archaeological heritage sites. The user is immersed in a virtual reconstruction of the Queen tomb and can interact with different artefacts, based on photogrammetric acquisition also taking advantage of previous survey campaign by the Lab Dhekalos. In addition, the prototype has been studied in order to tell the story of the findings to deaf and blind people, creating specific content based on the research carried out previously by archaeologists. The contents were realized in collaboration with experts in 3D digitization, archaeologists, and game engine developers.

*Scan to see
the prototype!*



Our

Testimonials

Nicoletta Frapiccini, Antiquarium Statale di Numana, Direzione Regionale Musei Marche, Ministry of Culture

KEY COMPETENCES

"The student Sofia Diomedi actively participated in both visitor reception activities and training sessions on historical topics and archaeological finds. She acquired essential competences encompassing archaeological knowledge, museum education skills tailored for engaging visitors, and effective communication abilities specifically geared towards conveying archaeological content to diverse audiences, including children and individuals with disabilities."



CHALLENGES

"There were no problems during the traineeship, nevertheless a challenge lied in the lack of archaeological background in the trainee. It has been partially overcome in the interdisciplinary team that supervised her work."



Scan to see the
student interview!!



Digital library of lithic archaeological elements from the Chalcolithic site of "Cerro de los Castillejos" (Fuente Obejuna, Córdoba)

Prototype

Student: Francisco Rafael Bueno Lozano

Supervisor: Antonio Monterroso Checa, Massimo Gasparini (Universidad de Córdoba)

This digital library collects 3D models of lithic finds preserved in the local historical museum of Fuente Obejuna (Córdoba) and that proceed by the Chalcolithic site of "Cerro de los Castillejos". The work was composed by the photogrammetric workflow on the lithic finds in the museum, bibliographic review to collect historical information about the objects and, finally, the upload of the models to specific collections on the Sketchfab platform and description of the archaeological finds through points of interest placed on the 3D model. Thanks to this consolidated workflow, it is possible to offer, in an easy way, a valuable user-experience that make easier the research process and the dissemination of the collections of the local museum.

*Scan to see
the prototype!*



Digital library of bronze archaeological finds preserved in the local Museum of Fuente Obejuna (Córdoba)

Prototype

Student: José Manuel Ordoñez Sojo

Supervisor: Antonio Monterroso Checa, Massimo Gasparini (Universidad de Córdoba)

The digital collection gathers some bronze artifacts, proceeding by the Fuente Obejuna territory and preserved in its local museum. Data was acquired for photogrammetric workflow of diachronic bronze elements, spanning from the Chalcolithic era to the Arab period. Subsequently, the 3D models were uploaded to the Sketchfab portal, accompanied by annotations and descriptions that encapsulate information gleaned from existing bibliographic and archival analyses of the digitized artifacts. In this way, the user can observe with a high level of detail the refinements of a type of material that, in a museum setting, would not be possible to achieve.

*Scan to see
the prototype!*



Our

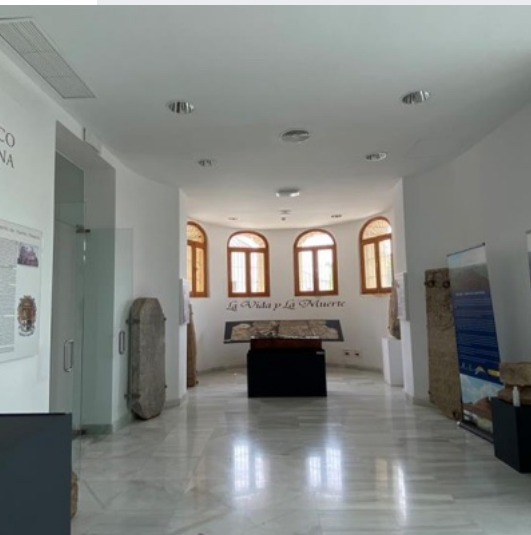
Testimonials

Francisco Manuel Osuna Luque, Tourism Office, Municipality of Fuente Obejuna

KEY COMPETENCES

"The students Francisco and José participated in the activity of digitisation of small finds preserved in the local museum of Fuente Obejuna (Córdoba, Spain).

They focused their work on the digitization through 3d photogrammetry of small finds, basically lithic industry of Chalcolithic Period and diachronic bronze elements."



CHALLENGES

"Taking into account the purely humanistic studies of the students, this was for them a useful experience to implement in a pragmatic way the technical knowledge acquiring in their participation in the DCBox Project.

In this way, they have understood the potentiality of the digital cultural heritage in the fields of the scientific research and dissemination and also the technical challenge that the management of these digital resources could represent for a small local administration with reduced resources."

Digital library of Roman sculptures from the Roman municipium of Mellaria (Fuente Obejuna, Córdoba)

Prototype

Student: Álvaro Castillo Arteche

Supervisor: Antonio Monterroso Checa, Massimo Gasparini (Universidad de Córdoba)

The digital collection gathers fragments of sculptures proceeding by the Roman city of Mellaria and its surrounding territory. The work process involved the photogrammetric workflow on the sculptural fragments preserved in the local museum of Fuente Obejuna, the analysis of existing bibliographic references related to the finds and, finally, the upload of the 3d photogrammetric models to a specific collection on the Sketchfab portal, accompanied by descriptions and annotations. These annotations encapsulate information gleaned from bibliographic and archival analyses.

This established process of acquiring and utilizing digital twins allows for broader dissemination of the collections of local museums, that are often underrepresented in major tourist and cultural routes..

*Scan to see
the prototype!*



Digital library of Roman epigraphies from the Roman municipium of Mellaria (Fuente Obejuna, Córdoba)

Prototype

Student: Paola Osuna

Supervisor: Antonio Monterroso Checa, Massimo Gasparini (Universidad de Córdoba)

This digital library collects the Roman inscriptions proceeding by the Roman town of Mellaria. The work was organized in the hologrammetric workflow on the epigraphies preserved in the local historical museum of Fuente Obejuna and on the inscriptions reused in the construction of the church of "Nuestra Señora del Castillo"; reviewing of the existing literature on the inscriptions and, as final step, the upload of the 3D models on the Sketchfab platform and description of the finds through points of interest placed on the 3D model.

Through this well-known process of digitization, it is possible to achieve a wider dissemination for the collections of the numerous local museums that populate the Spanish the territory and poorly known at regional and national level.

*Scan to see
the prototype!*



Testimonials

Francisco Manuel Osuna Luque, Tourism Office, Municipality of Fuente Obejuna

KEY COMPETENCES

"The students Álvaro and Paola participated in the activity of digitisation of lithic roman finds preserved in the local museum of Fuente Obejuna (Córdoba, Spain).

They focused their work on the digitization through 3d photogrammetry of roman epigraphies and fragmented sculptures from the roman town of Mellaria."



CHALLENGES

"The students have been able to combine the technical knowledge that they learned during the DCBox project with their purely humanistic studies, which are fundamental in the process of bibliographic research and historical-archaeological analysis of the digitized elements.

In this way, they understood the benefits of combining multidisciplinary knowledge for the management, dissemination, and study of cultural heritage and that can be applied in the same way in every cultural context."

Nicosia: Evolution of a city

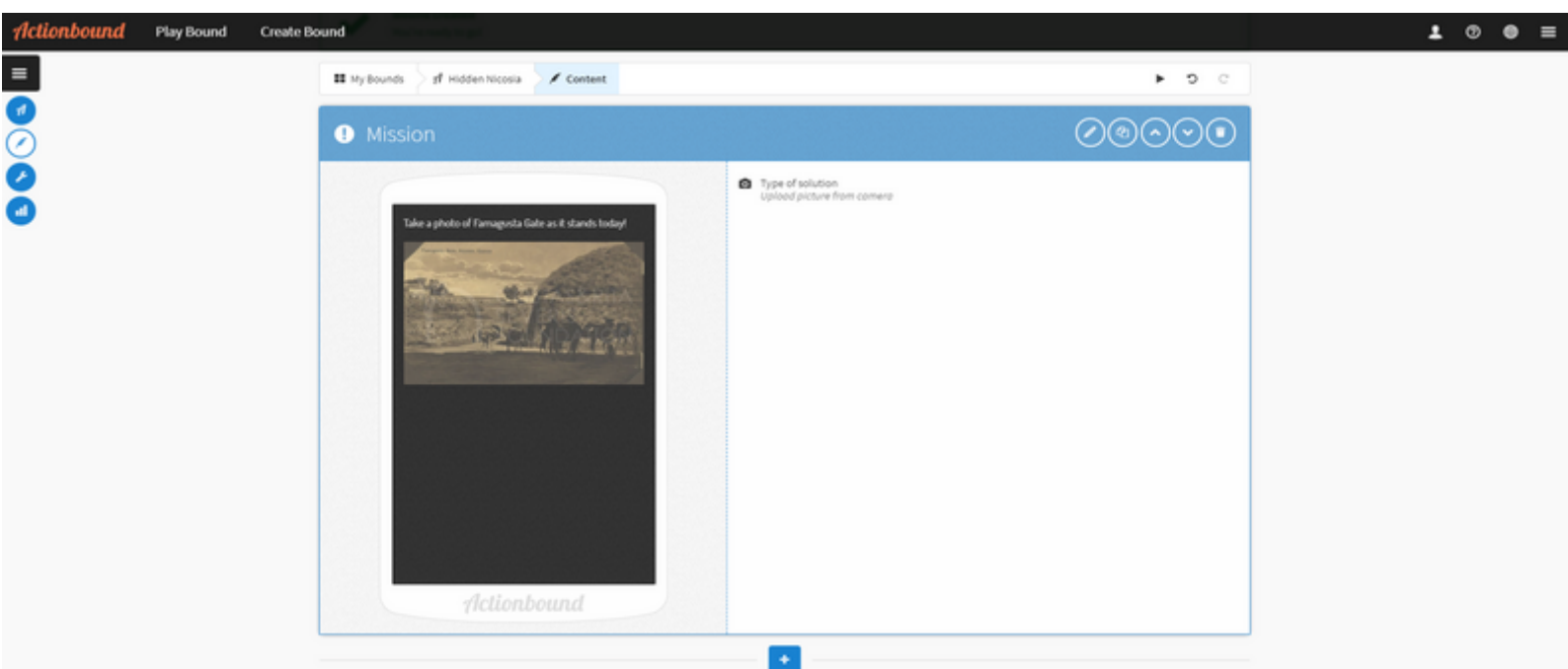
Prototype

Student: Natalie Milanese Branca

Supervisor: George Artopoulos (The Cyprus Institute)

Actionbound is an app for playing digitally interactive 'scavenger hunts' to lead the learner on a path of discovery. This app can be used around the historic centre of Nicosia to explore the historic locations around the city (starting from the Bronze Age to the present) that are no longer visible. The app can be used for education purposes and as a tool to explore the hidden history of Nicosia. Utilising historic photos, primary accounts of travellers and archaeological sources and artefacts the user will be able to explore how the city of Nicosia evolved through time.

*Scan to see
the prototype!*



Behind the lattice-wood veil: Moving through Ottoman Nicosia from a woman's point of view

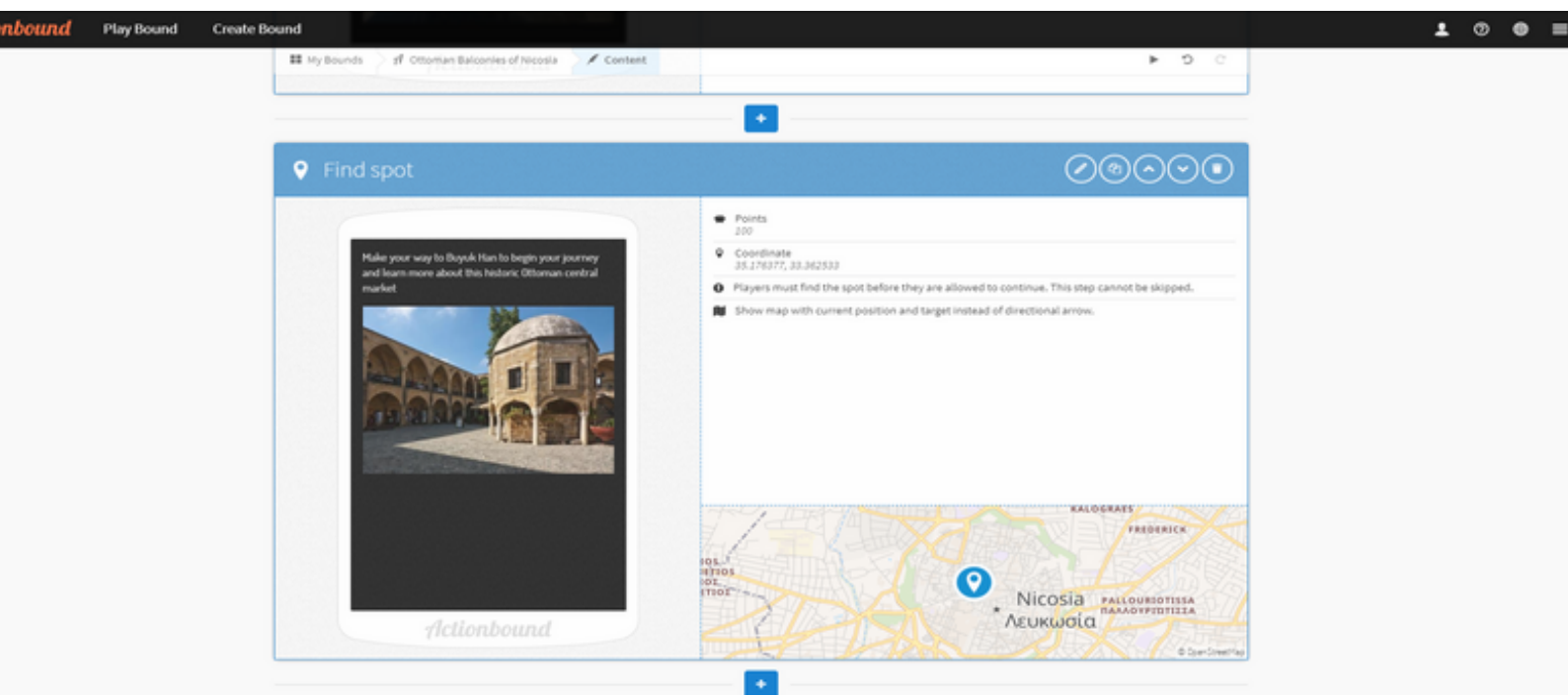
Prototype

Student: Nicolette Vollero Levy

Supervisor: George Artopoulos (The Cyprus Institute)

Using the Actionbound platform, users navigate the historic centre of Nicosia and discover Ottoman-era landmarks, following a narrative route designed to bring awareness to the role of gender in the division of space and architecture. As the user traverses the city, they learn more about the unique experiences of women, whose access to these spaces was dictated by gender and class. Monuments on both sides of the UN Green Line are included in the route, and each stop is enriched by archival material including photographs, architectural plans, drawings, paintings, traveller accounts and contemporary literature. A focal point is the historic house museum of Hadjigeorgiakos Kornesios, where the user is guided from an exterior to interior view to experience life behind the veil of a lattice-wood balcony.

Scan to see
the prototype!



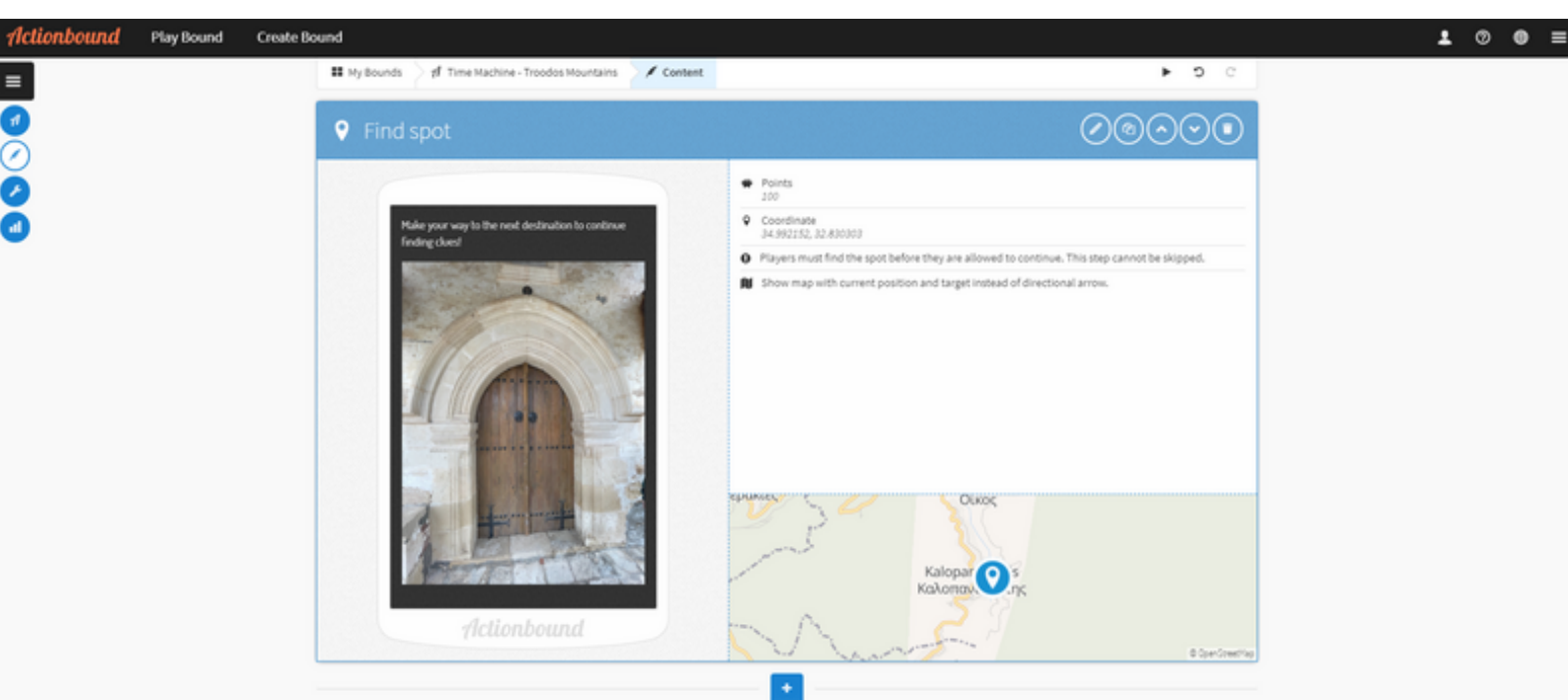
Time Machine – Historical Forests of Troodos

Prototype

Student: Theo Shaheen McConnell & Sayedeh Soodabeh Sajadi
Supervisor: George Artopoulos (The Cyprus Institute)

This gamified virtual tour of cultural and natural heritage sites along trails in the Troodos mountain range will inspire the users to immerse themselves in the history of the forests. This history will include descriptions, both textual and visual, of past cultural practices that have helped shape the forested environment we see today. The users will be able to take on the role of a character that will provide information to find clues in the current location in order to be able to move to the next location. This app will be very useful also in term of tourism, it will allow users following the game and the clue to visit various heritage sites and plan a road trip around the Cypriot mountainous landscape.

*Scan to see
the prototype!*



Living Palaeontology: Sharing Stories About the Rare Dinosaur Fossil

Prototype

Student: Edson Lourenço

*Supervisors: Carlos Smaniotto Costa, Catarina Patrício, Isabel Dantas dos Reis
(Universidade Lusófona)*

Co-supervisor: Carla Tomás, Museu da Lourinhã

Collect the digitized data from the fossils and their respective discovery sites, ensuring comprehensive coverage. Conduct in-depth interviews with the two researchers, extracting detailed insights and anecdotes to compile rich information for constructing the subpage (guided or virtual). This subpage will seamlessly integrate into the existing museum website, providing an immersive experience for visitors. Develop the subpage's design with meticulous attention to detail, including a user-friendly navigation map and intuitive controls. Populate the subpage with captivating narratives elucidating the fossil discoveries, supplemented by compelling statements from the researchers obtained during the interviews. Additionally, curate a diverse range of visual content and multimedia elements to enhance engagement and foster deeper understanding among visitors.

*Scan to see
the prototype!*



Our

Testimonials

Carla Tomás, Scientific Coordinator of Museu da Lourinhã

KEY COMPETENCES

"Edson Lourenço, through his endeavours in Vertebrate Paleontology, has honed his skills, delving into the dynamics of how communities contribute to preserving and appreciating paleontological heritage. He recognizes the profound impact such heritage can wield, as a repository of ancient life and as a catalyst for cultural enrichment. His work exemplifies the interconnectedness between scientific inquiry, community stewardship, and societal progress, highlighting the significance of fostering a collective responsibility towards our prehistoric legacy."



CHALLENGES

"It was challenging to reconcile the schedules and calendars amidst the intricate dynamics of various commitments and obligations. However, like Edson Lourenço's approach in Vertebrate Paleontology, meticulous planning and effective communication helped navigate through complexities, emphasizing the significance of collective responsibility towards our heritage and fostering societal progress."

*Scan to see the
student interview!!*



Storytelling on Ethnography: Lime kiln

Prototype

Student: Isaac Santo

Supervisors: Carlos Smaniotto Costa, Catarina Patrício, Isabel Dantas dos Reis (Universidade Lusófona)

Co-supervisor: Vanessa Antunes, Integrated Researcher of ARTIS-FLUL, collaborator researcher at Museu da Lourinhã

Prepare a concise overview detailing the limestone processing process and its significance in vernacular architecture within Lourinhã. Utilize a 3D model of a kiln to illustrate the initial stage of a lime route, connecting various stations including the quarry, kiln, and subsequent uses. This immersive approach aims to educate visitors on the historical and architectural importance of lime production in the region, offering a holistic understanding of its role in local heritage and construction practices. Through interactive exhibits and informative displays, visitors will gain insight into the intricate process of lime production and its transformative impact on the cultural landscape of Lourinhã.

*Scan to see
the prototype!*



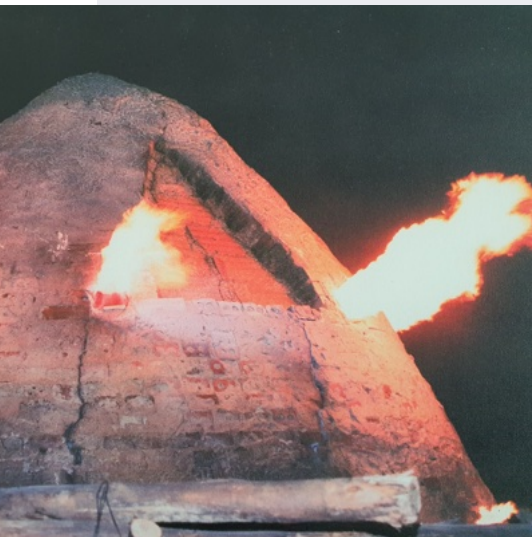
Our

Testimonials

Vanessa Antunes, Integrated Researcher of ARTIS-FLUL, Collaborator Researcher at Museu da Lourinhã

KEY COMPETENCES

"During the internship, Isaac Santo not only developed key skills in geological research and mapping but also demonstrated a remarkable aptitude for interpreting complex data sets. His ability to analyze geological and heritage data, coupled with his proficiency in digital literacy, enabled him to make significant contributions to the identification and analysis of sites such as the Lime Kilns of Moledo and Ventosa. His dedication and competence in this regard highlight his potential as a valuable asset in future projects within the fields of geology and heritage conservation."



CHALLENGES

"A significant challenge that emerged during the internship was the difficulty in obtaining comprehensive information regarding the structural intricacies of the designated sites. Overcoming this hurdle necessitated a proactive approach from student Isaac, involving outreach to specialists and thorough review of specialized literature. Nevertheless, confronting this challenge also presented valuable opportunities for him to refine his independent research skills, thereby enriching his overall learning experience."

Storytelling on Expography: 40 years of Museu da Lourinhã

Prototype

Student: Ruben Domingos

*Supervisors: Carlos Smaniotto Costa, Catarina Patrício, Isabel Dantas dos Reis
(Universidade Lusófona)*

Co-supervisor: Carla Abreu, Museu da Lourinhã

The prototype chronicles 40 years of museum history, emphasizing the significance of the Gruta da Feteira (Feteira cave) as the site of initial historical discoveries. It involves crafting a dynamic platform or application enabling public interaction, exploration, and learning with museum exhibits. This immersive experience aims to deepen visitors' understanding and appreciation of the region's cultural heritage, fostering a connection with the past and enriching their museum visit through interactive engagement and exploration. Through innovative features and engaging narratives, visitors will embark on a journey through time, discovering the stories preserved within the museum's collections.

*Scan to see
the prototype!*



Our

Testimonials

Carla Abreu, Museum researcher of Museu da Lourinhã

KEY COMPETENCES

"During his internship, Ruben not only acquired invaluable learning skills but also delved deeply into the intricacies of local archaeological heritage, with a specific focus on the Gruta da Feteira archaeological site. His exploration illuminated the transformative role this site plays in fostering community-driven efforts towards heritage preservation and appreciation. Ruben's dedication to understanding and promoting the significance of cultural heritage reflects a promising commitment to the preservation of our collective history and identity."



CHALLENGES

"Given the constraints of time, Ruben embarked on a research endeavor, aiming to provide insight into the Prehistoric discovery. His approach was nuanced, drawing upon the realms of the sacred and the aura of enchantment. This interpretative angle not only added depth to his exploration but also highlighted the mystical dimensions intertwined with the archaeological narrative. Ruben's endeavor exemplifies a thoughtful engagement with the past, transcending mere academic inquiry to evoke a sense of wonder and fascination."



Scan to see the
student interview!!



Virtual experience of the Museum of Ponisavlje's exterior

Prototype

Student: Aleksandra Stojkovic

Supervisor: Bata Vasic (University of Nis)

This prototype represents a virtual tour of the Ponisavlje Museum exterior. Its central point is a 3D model of the museum, the best-preserved monument of traditional architecture in Pirot. The exterior includes an exhibition of a 20th-century Serbian school setting, a gazebo, and outbuildings used for storage and administration. The user can freely explore the museum's exterior through first-person controls, via keyboard and mouse. The tour contains audio, textual, and visual information to enrich the experience and make the application more accessible. The information is centered around the historical value of the museum, its first patron Hrista Jovanović, and his family, as well as the cultural development of Pirot in the set time. The prototype can further be gamified and enriched with added exterior objects and a more interactive storyline, including character personalization.

*Scan to see
the prototype!*



Our

Testimonials

Bojan Randjelovic, Muzej Ponisavlje

KEY COMPETENCES

"The main skill that Aleksandra acquired during her stay and work at the museum was the ability to transform the idea of a three-dimensional representation of cultural heritage into an effective game prototype. Aleksandra managed to understand the connection between elements of cultural heritage and the concept of modern digital representation and managed to turn this specific task of application development into an effective tool for educating the young generation."



CHALLENGES

"The main task in the initial phase of the stay in the museum was the research of technical documentation and architectural drawings of the building and auxiliary facilities. The most difficult challenge was the lack of information in the archive, which led her to use other hand techniques in designing 3D models. Here, Aleksandra distinguished herself with her resourcefulness, competence and precision, thus easing the duties of museum employees."

Scan to see the
student interview!!



Ponivaslje Museum - Interior Tour

Prototype

Student: Ana Janackovic

Supervisor: Bata Vasic (University of Nis)

The prototype represents a virtual tour through the interior of the Ponisavlje Museum. The idea of the prototype is to convey to the user the experience of visiting the Ponisavlje Museum, allow the user to easily navigate through the museum through a simple interface, and present him with the history of the museum through audio, image or text presentations. Prototyping consisted of a research part that included visiting the museum, collecting photos and information about the museum, and technical development that included writing code in the C# language, making 360 photos, and assembling the entire application in Unity. The application consists of an input menu that instructs the user about the application, and by clicking a button, the user starts the application. The main parts of the application include a button to move from one position to another, giving the user the impression of moving through the museum, and buttons that are attached to the exhibits. By clicking on them, the user gets more information about the exhibits and rooms, which gives the impression that the curator is right there in front of him.

*Scan to see
the prototype!*



Our

Testimonials

Bojan Randjelovic, Muzej Ponisavlje

KEY COMPETENCES

"Analysing museum challenges, such as exhibition design dilemmas or visitor engagement strategies, Ana has acquired the ability to think critically and develop innovative solutions. She managed to achieve the planned goal, which was reflected in the use of modern gaming digital tools and technologies for the task of the virtual exhibition, thus she undoubtedly succeeded in improving the digital literacy and adaptability of visitors in the digital museum landscape."



CHALLENGES

"The initial phase of Ana's stay in the museum, was research of techniques and types of artifacts in the entire interior of the museum. The most difficult challenge was the variety of artefact-making techniques and the variety of materials from which they were made. This problem prevented her from realizing her original plan of 3D digitization with available photogrammetry tools. Ana's competence and expertise was manifested in finding an adequate method and successful finalization of the prototype."

*Scan to see the
student interview!!*





CHAPTER 6

Essays

Digitisation and Storytelling

The Act of Telling Stories, the Cultural Industry in the Digital Age

Carlos Smaniotto Costa

Telling stories is a human expression and form of art that can inspire others (Schmidt, 2008). Storytelling is the creative process of communication and information exchange. Although an ancient human expression form, storytelling is becoming increasingly widespread, extending beyond communication and its actors. Reflecting on how people learn and communicate, how information, knowledge and skills are shared, storytelling can be an important link between citizens, policymakers and planners – between those who create and bear cultural goods, those who decide for their agenda and those who plan for and with them (Artopoulos, & Smaniotto, 2019). This means, storytelling can be also political (Patricio & Smaniotto, 2023), as it mobilises a particular body of knowledge to make it public. This evidences that many actors participate in telling a story.

Storytelling impacts human emotions. It can lead people to accept and embody ideas or encourage them to take action.

It can be persuasive and bring people to take sides. According to Litherland “... [stories] delight, enchant, touch, teach, recall, inspire, motivate, challenge. They help us understand. They imprint a picture on our minds”. This is undoubtedly an inspiring argument. The author goes on to point out that if “Want to make a point or raise an issue? Tell a story.” In effect, this highlights the “story” itself as the most important element of storytelling.

There are different ways of telling a story: visual stories in photographs, spoken stories in videos and recordings, and written words in books and blogs. Hence, storytelling can take different forms. Creating a good story can be challenging, and creating a culture of sharing and encouraging people to share their culture and learn about others. It can improve community relationships, and drive development results.

A range of academic disciplines are discovering and investigating the pow-

er of storytelling. In our context and environment, digital curation, heritage communication and, in particular, in environmental-design disciplines, like urban and regional planning and landscape architecture, in the context of heritage sites and studies are gaining ground as it is a means to bring people together, to share and valorise their own intangible and built heritage. Storytelling, as such, has multiple benefits, amongst which raising awareness has been assessed to be the most valuable to society (Taylor, 2014).

WORKING AT THE INTERFACE: STORYTELLING, HERITAGE AND SPATIAL PLANNING

In the cultural sector, storytelling has long been used for discovery, for moving the subject more into the public spotlight. Cultural institutions (such as museums, art galleries, archives, etc.) have been using storytelling as a co-creative tool to increase visitor's engagement and experience (Schmidt 2008; Floch & Jiang, 2015). Telling stories holds two facets, which are related to and dependent on each other. On the one side, is narrating and the form the information is transported; and on the other side, the way it is received and interpreted (remembering). In this way, storytelling builds bridges between the practices of both the heritage professionals and their audiences and between the narrating and remembering.

To attract and engage their audiences, cultural institutions use storytelling in different forms, like memorials, testimonials, branding, signage, etc. and combine visual communication (photographs, videos, slideshows, or animations) with audio. In the case of heritage subjects, storytelling can be also used to show the thread that runs from the past to the present. This provides the sense of continuity and belonging, which in turn can foster identity and help build awareness - a precondition to ensure the safeguard of cultural heritage.

For cultural heritage enhancement, storytelling can be a powerful, easier, quicker and cheaper effort to instigate diving deeper into the story of a community. Through the lens of storytelling, the community can thoughtfully be lead to value their heritage (Floch, Jiang, 2015). Heritage asset can thus act as a storyteller. This brings us back to the sense of belonging, and thus to the space or environment within which the story develops (van Blerk, 2019). Tying a spatial dimension to cultural and social aspects create a sense of place. Storytelling can thus tell about places. In a spatial context, the issues of Identity, sense of belonging and memories, can be relevant for building ties between the spaces and the community. In this context, placemaking, the act of making a place, has become one of the central concepts in the urban agenda. Placemaking, going beyond the physical

construction of spaces, is a powerful bottom-up process and a people-based instrument for intervening at the local scale (Smaniotto et al., 2024). Making use of local knowledge and promoting cultural identities are the cornerstone of placemaking. Furthermore, associated with an active civic engagement with one's own environment, placemaking creates the experience and enhances the visibility and publicness of the process, and can in the end affect urban development on the whole. Placemaking works like assembling jigsaw puzzles. It embodies the challenge of assembling single "picture pieces" into a cohesive city and society (EC, 2019).

In effect, the linkage between heritage and urban planning is emerging strongly as a response to the massive and rapid urbanisation, and the loss of heritage, cultural diversity and biodiversity among others. Yet, as Rivero Moreno (2020) notes, the importance of the cultural economy is opening a new perspective to urban rehabilitation and development. A bid to preserve the cultural identity and historical significance of cities calls for a full incorporation of cultural aspects/elements in urban planning activities (EC, 2019). The rise of the internet, digital tools and platforms like social media may enhance the visibility and publicness of concerns, deficits and on the flip side of projects and activities. This in turn, can increase the impact on decision-makers and organisations and/or provoke

effective counterpublics, thereby, create opportunities to preserve heritage and co-create urban space.

THE LINKAGE BETWEEN DIGITISATION AND STORYTELLING

Digital advancements are driving changes in society and thus in the way people communicate, interact and exchange, and how they use the city and the territorial resources (Smaniotto et al., 2019). Storytelling-based applications have mushroomed, which is a sign of their success. The Covid-19 pandemic and restrictions on physical gatherings may also have leveraged the development and demand for these tools. The ubiquitousness of digital technologies and instantaneous interaction promise to facilitate knowledge and information exchange, and take it from a limiting two-way communication. Innovations in digital participation extended opportunities for citizens to take an active part in public decision-making processes (Taylor, 2014) and to share own stories and experiences.

The ubiquitousness and instantness of digitisation and social media are challenging cultural heritage, traditionally associated with long-term values and stable content (Di Blas et al., 2009), but on the flip side, these qualities are opening new opportunities for communication and sharing cultural content. This can be a counter effect to globalisation and the loss of uniqueness. Then

storytelling associated with cultural heritage and its narrative presentation call for local and intercultural knowledge. Expressing local particularities can work as a counterpart to global dependence. The emergence of digital culture has added an additional layer to the cultural sector. In this wave, storytelling can be also considered an agent for inclusion, participation and partake. At the same time, digitisation is becoming a key practice within cultural work, in the sense that narratives need to be crafted as a way to describe situations, ascribe roles and motives, and set or negotiate interactional goals - and this simultaneously in several technological channels (from Web to mobile devices, to iPod, to information points, to iPhone), as Di Blas et al. (2009) illustrate.

The ubiquity of digital technologies and the lure of "instantaneousness" can, however permeate the notion of cultural goods with long-term values and stable content. The rapid changes and recent developments in communication and globalisation reignite the debate of what constitutes heritage, who defines it, and how and for who it is preserved (Waterton & Watson, 2015). Despite this

fundamental discussion, storytelling enables different narratives, styles and diverse situations, and triggered by digitisation added now with new opportunities like immersive storytelling or augmented-reality storytelling.

Just as placemaking, as discussed above, storytelling and social media are influencing popular awareness and thus eliciting responses from decision-makers and organisations.

Despite the digital transformation and heeding the call to innovatively and creatively generate content, digital tools are simply a means to an end. The infinite possibilities of digitisation are challenging society. Despite of becoming utterly dazzled, overwhelmed or blinded, it is opening new opportunities. We still need to fully understand whether digitisation is making the processes more democratic and sustainable, and users are becoming more engaged by digital tools. However, locally rooted storytelling can act against the homogenisation of culture and loss of identity (European Commission, 2019).

Finally, the maxim remains if you have an issue tell a story.

Digital Transformation and Architectural Heritage

How to Support the Triple Helix of Knowledge, Conservation, and Dissemination?

Ramona Quattrini, Chiara Mariotti

DIGITAL TRANSFORMATION FROM THE PERSPECTIVE OF CULTURAL HERITAGE: A BRIEF OVERVIEW

For several years, we have been facing epochal transitions, in particular the green and digital ones, which have significant impacts on our society, environment, economy, and culture. At the cultural level, and specifically in relation to cultural heritage, the European research programmes are primarily asking for the design and development of value-oriented and sustainable strategies to accompany these transitions (European Commission, 2022; Muench et al., 2022). The strategic agenda for cultural heritage and its transition reflects a dual tension. On the one hand, there is the willingness to take advantage of heritage as a dynamic resource with an adaptive capacity to respond to change. On the other hand, there is

the concern to maximise the physical permanence of heritage as a unique and non-renewable resource through knowledge-building, the conservation of material and memorial stratifications, and the dissemination and sharing of cultural content.

Several international policy documents have addressed the digital transition and emphasized the need to create synergies between heritage conservation and digitisation, which has been significantly boosted due to the Covid pandemic (European Heritage Alliance, 2020). To ensure brevity and clarity in this essay, it is useful to refer to the ICOMOS dossier on *Quality Principles* that outlines seven key pillars for all stakeholders involved in EU-funded projects and process on heritage conservation and management. Two of these are “knowledge-based actions”

and “good governance” (Dimitrova et al., 2020), which can be greatly supported by digital technologies, both in terms of data storage systems and process structuring. The European Union’s commitment in building competencies and tools to embrace the digital transition and encourage qualified innovation in the field of cultural heritage has been confirmed in some of the most relevant Italian programmes, including the National Strategy for Intelligent Specialisation (SNSI), the National Research Plan (PNR), the National Recovery and Resilience Plan (PNRR) and, above all, the National Plan for the Digitisation of Cultural Heritage (PND), issued by the Central Institute for the Digitisation of Cultural Heritage - Digital Library of the Ministry of Culture. In this context, it is worth mentioning the *Guidelines for the Quality of Architectural Restoration Projects* recently drawn up by the Italian Society for Architectural Restoration, which emphasises the use of digital methodologies to enhance and manage architectural heritage (SIRA, 2023). This position paper picks up again on the theme of quality, which has been brought strongly to our collective attention by the *European Year of Cultural Heritage* in 2018, whose framework for action was based on five pillars for an inclusive, sustainable, resilient, innovative and stronger co-operated Europe that relies heavily on the contribution of digital means (European Commission, 2019).

In addition, the strength of these new practices lies in sharing knowledge and responsibilities for heritage protection and preservation with the community. This allows for co-designing processes that promote conscious re-appropriation of heritage as an identity and socio-economic resource, as established by the Faro Convention (Council of Europe, 2005). In this perspective, the research and innovation calls of the Horizon 2020 programmes emphasised the impact of the digital transition on society. This was particularly highlighted in the work plan of “Societal Challenge 6: Europe in a changing world - Inclusive, innovative, and reflective societies”. The issue was then addressed in the Horizon Europe programmes, specifically in the work programme of “Cluster 2: Culture, Creativity and Inclusive Society”. In line with this proactive approach, Europeana PRO launched several initiatives aimed at supporting the cultural heritage sector in its digital transformation, developing expertise, tools and strategies to embrace digital change and foster partnerships that promote innovation (Europeana, 2022). The *Porto Santo Charter* has also recently returned to the social impact of digital transformation; it values cultural democracy as a primary objective of any cultural initiative for which digital transition can be an enabling factor. The Charter highlights the significance of diversity in accessing, producing, and sharing cultural content, and all opportunities for digital transforma-

tion are seen as facilitators of “cultural citizenship and digital territories”. The document also encourages digital literacy programmes and actions to overcome exclusion and ensure access to digital content of culture, heritage and the arts. This provides equal opportunities for people to participate, create, and enjoy online cultural experiences (Porto Santo Conference, 2021).

The issue of digital literacy is crucial because digital technologies have become indispensable in all areas of life, including work, education, socialising, and access to services ranging from health to culture. Dependence on digital technology has also exposed its weaknesses, such as the digital divide that still affects many countries. The persistent digital presence has thus led the European Union to establish a *Digital Compass* to monitor the progress of the digital transition, close gaps in strategic capabilities, and implement specific targets by 2030 in view of a “human-centred, sustainable and more prosperous digital future” (European Commission, 2021). The four cardinal points of the European Digital Compass – skills, infrastructure, business, government – align with a community policy that opens up new perspectives and challenges for culture and cultural heritage, supported by the recognized contributions this sector can offer to transition and development processes. Empowering individuals to acquire

skills forms the cornerstone of numerous programs and projects designed to engage and cater specifically to various actors, including experts and non-experts, who participate in the processes of knowledge acquisition, conservation, and dissemination of cultural heritage.

HERITAGE DIGITAL TRANSITION PUT INTO PRACTICE

These theoretical and methodological approaches, which are widely accepted and supported, unfolded a challenging field of research and experimentation for cultural heritage. Technology is increasingly becoming a crucial component in complementing traditional processes, providing necessary and directed technological support for the objective of heritage conservation and enhancement. In line with these assumptions, the text provides an analysis of two research projects conducted by the interdisciplinary laboratory on digital cultural heritage DISTORI at Università Politecnica delle Marche (Italy), aiming to give an overview of their complexity and potential for exploration.

“The need to find a new use, to define a conservation project to govern the phenomena of degradation in the short term, to enable tools for its conscious and sustainable management in our critical present made it a key pilot to verify how technology and digital transition could facilitate these objectives in a sustainable, inclusive and innovative perspective.”

The first case concerns Villa Leonardi, a historic house located in the hinterland of the Marche region, in Treia, province of Macerata (Italy). Built at the end of the 19th century on the remains of a pre-existing farmhouse, Villa Leonardi is now surrounded by a 7,000 square metres garden that includes two out-buildings and a row of holm oaks leading to the Potenza River, which were declared historical-artistic interest in 2006, by the Italian Legislative Decree 42/2004. The house has been unoccupied for decades, which has resulted in a lack of use and periodic maintenance, negatively impacting its condition. The need to find a new use, to define a conservation project to govern the phenomena of degradation in the short term, to enable tools for its conscious and sustainable management in our critical present made it a key pilot to verify how technology and digital transition could facilitate these objectives in a sustainable, inclusive and innovative perspective. In the initial stage, the research developed a workflow based on non-parametric automatic 3D modeling and Industry Foundation Classes (IFC) authoring to combine geometry and semantic information (Angeloni et al., 2023). The proposed workflow consists of five steps: the 3D survey campaign and raw data processing, the semantic annotation of images according to different information layers, the annotation transfer from images to the point cloud representing the studied architecture, the obtained Point Cloud

Information Model (PCIM), automatic segmentation and 3D mesh wrapping, and finally the IFC generation for the Heritage Building Information Modelling (HBIM) representation. The final output is a 3D model of the building, automatically processed from digital survey data, and semantically enriched thanks to the material consistency and decay analysis obtained and annotated using spherical panoramas. The effectiveness of this approach was proven in the conservation project for the façades of the house: enriched data on materials and decay supported an action plan of restoration works, which was then recorded in the HBIM, thus permitting time and cost control. Another test explores the potential of open-source software tools for semi-automatic point-cloud segmentation in enriching heritage knowledge and contributing to the inspection of its state of conservation, with the aim of consciously integrating traditional and innovative methods (Nespeca et al., 2024). This ensures a 3D geometric view of reality and enables the identification of criticalities that may not be visible to the naked eye through colorimetric attributes. The investigation focused on the east and south elevations of the building, which were suitable for two distinct trials: a semi-automatic procedure for analyzing the quality of mortar joints in exposed masonry, and a semi-automatic procedure for mapping alterations and decay in plastered masonry. To validate the results, man-

ual and semi-automatic obtained maps were compared using both qualitative and quantitative assessments. Qualitative assessment involved overlay and visual analysis, while quantitative assessment involved transforming the segmented point cloud into a mesh and calculating the resulting surface area. Additionally, a HBIM model was built up in order to test a complete modelling workflow that from the integrated survey, co-ordinated with the constructive and material knowledge of the building, passing through the degradation analyses. Its main goal was the complete modelling of knowledge with adequate Levels of Detail and the preliminary check of some peculiar aspects of the conservation project, as a basis for future management plans. The critical interpretation of this case study revealed both advantages and disadvantages; overall, experimentation highlighted the added value that advanced digital process can bring to the issue of heritage preservation.

The second case study – the Palazzo Olivieri-Machirelli in Pesaro (Italy), currently in use as a music conservatory – is developed on a historical building resulting in a complex stratigraphy in terms of volume. However, significant capabilities need to be enhanced, even if it is still in use. The architectural complex, which includes the Auditorium Pedrotti, is linked to the legacy of the main historical figure of the town: the opera composer Gioachino Rossini.

For its prominent position, barycentric in respect to other urban public spaces, but also being underexploited as a venue for public performances, highlights opportunities for broader community engagement. Thus, a need for strategic innovation arises, leveraging a combination of physical and virtual space utilization to unlock its full potential. The main objectives of the technology-oriented research implemented in this case study stem directly from its characteristics: a physical and virtual experience was hypothesized to facilitate its role as a venue for performances and to highlight its connection with the Rossini personality. Therefore, the applications were intended to multiply opportunities for both material and immaterial reappropriation. Digital transformation was thus employed by embracing the paradigm of informed modelling to facilitate management and leveraging the potential of eXtended Reality (XR) to convey cultural content. The study, extensively presented also in Clini et al. (2023), explored the potential of digitizing architectural heritage through HBIM and XR. The research investigated HBIM applications in managing and narrating tangible and intangible aspects of cultural heritage. A comprehensive workflow was tested, beginning with integrated surveys to create high-quality numerical models adaptable for various purposes and Levels of Detail. A key advancement was achieved through the interoperability of HBIM with XR applications,

allowing for engaging presentations of the historical building and its evolution over time. User-friendly applications, including augmented reality (AR) and mixed reality (MR), were developed to make invisible concepts visible, such as depicting the building phases and recreating historical performances in the Auditorium Pedrotti. Overall, the study demonstrated HBIM efficacy in narrating the temporal dimension of architectural heritage and preserving intangible cultural memories.

CONCLUSION NOTES

Both the exemplifications presented here demonstrated the same backbone: a technological approach and the use of digital technologies to address the challenges of adaptive reuse and conservation of heritage considering its material and immaterial values. The digital technologies employed different tools to meet diverse needs, all while remaining aligned with the specific features and vitality of cultural heritage under consideration. The research is triggered by the digital transformation consequences and oriented to principles such as quality, scientific rigor, and usefulness for communities. Data capturing, data mining and algorithmic analysis, point clouds enrichment and HBIM, and XR are exploited to enlarge the data uses and to enhance heritage knowledge, conservation and dissemination, as a triple helix.

As in the history of humans, technological revolutions have always innovated the way we interact with the reality and especially with culture. For example, photography was the spring that triggered Andr  e Malraux's reflections on his *Mus  e Imaginaire*, a "Museum Without Walls" according to the most accepted English translation. There is a prevailing consensus that what was achievable in the 1990s with photographs can now be replicated digitally, particularly in the realm of three-dimensional replicas, especially when concerning architecture and spatial environments.

However, enthusiasm for technology and digital can be dangerous and prone to meaningless drifts, especially since technology is by its very nature a form of religion (Valerio, 2023). Indeed, the author recommends that we should not abdicate our responsibilities by relying solely on algorithms, questioning that with the algorithm you do not have to be good or bad, it does everything for the person. Now that Artificial Intelligence (AI) has become a desk tool with the web services based on open AI, the renunciation of individual responsibility is even more worrying. Although most definitions state that AI should imitate the logic of the human mind, Mario Carpo (2018) affirms it is increasingly evident that computers can solve some hitherto impervious categories of problems precisely because they follow their own, quite distinctive logic. In spite of this,

emerging principles for the responsible use of AI always emphasise the need for human supervision, as in the law just passed by the European Parliament.

Considering similar risks and perspectives, this essay has described approaches aimed at fostering the digital transition and facilitating the responsible integration of traditional and innovative tools and methodologies for heritage conservation and enhancement. Digitisation can take on various

forms that enhance knowledge, data storage systems, diagnostic investigation methods, and cultural accessibility to architectural heritage. It also improves the verification of coherence between project premises and objectives. Both cases have demonstrated more positive than negative aspects. However, it is important to note that the updating of these processes must be critical and conscious. Similarly, actions on heritage should never be entirely automated.

The Everlasting Amazement of Visual Culture: an Essay on the Necessity of Wonder in the Digital Transition

The Digital Archive and the *Wunderkammer* Metaphor

Catarina Patrício

“Perhaps the most deeply hidden motive of the person who collects can be described this way: he takes up the struggle against dispersion.”

Walter Benjamin, Das Passagen-Werk

We, humans, collect: there is a seminal and enduring human inclination towards wonder and the assembly of “marvellous things”. This is rendered evident in the everlasting amazement of visual culture. As an attempt to delve into the ontological implications of the collector, and by tracing its genesis from the historical cabinets of curiosities to the fluidity of contemporary digital archives, one finds the necessity of wonder at a collection as a constant in the immemorial human struggle against dispersion.

In the realm of human experience, the interplay between wonder and questioning forms an intrinsic connection, anal-

ogous to the inseparable bond shared by amazement and curiosity. According to art historian John Onians (1994), this connection is not merely incidental but rather a universal response embedded within the human mind. Onians posits that wonder and questioning emerge as a shared and innate reaction in individuals when confronted with a profoundly novel and dazzling visual or auditory stimulus – “To ‘wonder’ is merely to ask oneself a trivial question, but to feel ‘wonder’ is to acknowledge the impact of an extraordinary sensory experience.” (Onians, 1994: 11)

In “I Wonder: A Short History of Amazement” Onians conducts an archaeo-

logical exploration into the origins of collecting, highlighting key historical periods where these human tendencies flourished. The first focus is the New Kingdom of Egypt, with Queen Hatshepsut's expeditions to Punt (now Somalia) and the representation of the collection detailed in the hieroglyphs found in Amun temple, "a wealth of items including 'thirty-one living myrrh trees, electrum, eye paint, throwing sticks, ebony, ivory, shells, a live southern panther, panther skins' and so on". (Onians, 1994: 26). The second historic collectors that have anticipated the *Wunderkammer* are found in Assyria between the 11th and 9th centuries BC, as Tiglath Pileser's attention to visual details in his palace and Adad Nerari II's establishment of a zoo reveal early forms of collecting (Onians, 1994: 28-29). Then, it delves into the Hellenistic period, illustrating the confluence of art, intellect, and curiosity, followed by the Roman Empire. The Baroque era triggered the *Wunderkammer*, providing insights into the interplay of aesthetics, wonder, and intellectual pursuits during this period, due to the obsession with collecting and displaying diverse and intriguing objects.

We find ourselves bound not just by the tangible threads of reality, but also by the intangible filaments of wonder

– aroused by material objects, fossils and artefacts, but also by more elusive objects such as in myths, parables, songs and stories. In common, they all have stimulated the necessity of wonder. As the musealisation of collections and heritage, aligned with the modern constitution of archive it has undergone a transformative shift with the digital age, the traditional boundaries that once confined musealisation and content production have dissolved, giving rise to a reevaluation of the concept of the archive, introducing shifts in the dynamics of knowledge and on the authority over the collection. But memory weaving through time remains the same.

THE DIGITAL ARCHIVE AND THE WUNDERKAMMER METAPHOR

The digital archive conveys a realm where space and time become malleable: virtual museums, augmented reality exhibits, and immersive platforms signal a departure from the materiality of traditional archives. Nevertheless, the digital archive is the preservation of wonder.

This is rendered clear in Ed Finn's metaphor of the digital *Wunderkammer* for the digital archive (Finn, 2017: p. 156) which, like historical *Wunderkammers*

¹ In Parikka's media archaeology, shaped by the influence of Foucault, the approach operates as a hermeneutic methodology, systematically uncovering the historical strata within media systems. This methodology assists us to assert with Onians that the first collections possess material traces that enable us to discern the evolution of wonder through the lens of diverse artefacts and technologies over time. Cf. Parikka, J. (2012). *Media Archaeology: Approaches, Applications, and Implications*. University of California Press.

or cabinets of curiosities, serve as “hyper”-spaces where a diverse array of artefacts is collected and curated. In the digital realm, the archive becomes a repository not only for traditional documents but for a wide range of digital information, including text, images, videos, and more. This collection is not organized in a linear or hierarchical structure but rather reflects the non-linear and interconnected nature of digital data. The *Wunderkammer* emerges as a metaphor emphasizing precisely this eclectic and serendipitous nature of exploring digital archives. Users can encounter a mix of information and artefacts, fostering a sense of curiosity and discovery similar to exploring the diverse contents of a historical cabinet of curiosities.

In addition, and emphasising the architectural nature of computing, Bolter and Grusin draw parallels between the “hypermediacy of the baroque” (1999: p. 36), and the digital archive, reflecting the human fascination with novelty and the extraordinary. A close look at the *Wunderkammer* tradition will deepen these collecting dynamics, merging tangible and intangible and thus challenging perceptions, all while inviting to a multi-sensorial contemplation.

Wunderkammer collections diverge from a linear or hierarchical structure and rather reflect the non-linear and interconnected nature of digital data.

At its extreme, having a complete digital archive would be a digital equivalent of Earth’s images and its “marvellous things.” Finally, with Denis Cosgrove’s “Cartographic Genealogy of the Earth in the Western Imagination,” the globe as a divine *Wunderkammer*, resonates within the digital realm:

“If the globe was a divine Wunderkammer, its representation was a Gesamtkunstwerk.” With the digital, it is not a question of “if” but rather “when”. (Cosgrove, 2001: 154)

HISTORICAL ROOTS: THE NECESSITY OF WONDER

Tracing the roots of the enigmatic *Wunderkammer*, art historian John Onians finds wonder as a fundamental human response to a striking experience: “To ‘wonder’ is merely to ask oneself a trivial question, but to feel ‘wonder’ is to acknowledge the impact of an extraordinary sensory experience.” (Onians, 1994: 11)

Wonder is not merely an emotional response but a cognitive process towards the extraordinary. Wonder and questioning are as intertwined as amazement and curiosity, forming a universal response to the new and puzzling (11). This has been the sensory stimuli that launched Modern Science.

"The great period of wonder of the sixteenth and seventeenth centuries AD came into being as a result of an excess of novelty, and was brought to an end, as nature prescribes and Bacon and Descartes had foreseen, by a wave of explanation and classification." (Onians, 1994:26)

The cabinets of curiosities of the 16th and 17th centuries played a pivotal role in the development of modern science and visual culture, with wonder acting as the catalyst metaphor for learning and exploration. Edmund Burke, adds Onians, in his treatise *Philosophical Inquiry into the Origin of the Ideas of the Sublime and the Beautiful* (1757), recognized amazement as a fundamental category of aesthetic experience. Bacon and Descartes, contemporaries of the explosion of *Wunderkammer*, considered wonder as the seed of knowledge (Onians, 1994: 26). The collections of these cabinets were very heterogeneous: prehistoric artefacts, objects collected from other cultures in the diaspora and other ethnographic curiosities, as well as fossils and geological objects, embalmed animals, exotic specimens of fauna and flora, were preserved. These cabinets could also display collections of paintings (some of these collections were the origin of important museums, such as the Louvre Museum). The cabinets of curiosities ended with the separation

of collections into Art Museums and Natural History Museums.

As each age encountered the unfamiliar, a pause for wonder was ensued, fostering curiosity and learning:

*"Each time new conquests brought people into contact with the **unfamiliar** they had to **pause** and **wonder** at it. [...] The phenomenon recurs, not because one age copies another, but because the genetic adaptation which had assured man's survival for millions of years was still there to be activated." (Onians, 1994; 30-31. Our emphasis)*

The 21st-century digital age still seems deeply entangled with a similar wave of explanation and classification. The contemporary *Wunderkammer*, with its digital wonders, serves as an indication of the constant return to the necessity of wonder.

NAVIGATING THE LABYRINTH OF AUTHENTICITY AND PRODUCTION

Umberto Eco's exploration of collections of marvels resonates with the digital casual attitude toward authenticity: in the age of hyperreality, the authenticity Ripley's Museums advertise is a visual one². "The copy is authentic," states Umberto Eco (1986: 124) and so are the digital models for the digital archive. Reason is in the randomness process of the collector – the criteria is assembling:

² "[...] "collections of marvels the uncritical accumulation of every curious find; the difference lies in the more casual attitude toward the problem of authenticity. The authenticity the Ripley's Museums advertise is not historical, but visual. Everything looks real, and therefore it is real; in any case the fact that it seems real is real, and the thing is real even if, like Alice in Wonderland, it never existed." (Eco, 1986: 40-41)

"[...] the Wunderkammern of the sixteenth century, collections of diverse and wondrous objects, unconsciously anticipating the taste for the assemblage, for the "bricolage" of the pop artist who juxtaposes things out of context." (Eco, 1986: 542).

This leads us to the essence of collecting. In Walter Benjamin's unfinished work *Passagenwerk*, the collector is presented as a kind of cultural producer who lives within randomness. The authority of the collector of the digital archive can still be unfolded in the following five dimensions, following Walter Benjamin's fragment "The Collector":

1. **Detachment and Completeness:** Collecting involves detaching an object from its original functions, placing it in a new context within a collection³.
2. **Enchantment and Magic Circle:** The collector finds deep enchantment in a metaphorical magic circle, a process that transforms the collected items into repositories of knowledge⁴.
3. **Tactile vs. Optical:** Collectors are described by Benjamin as beings

with tactile instincts, in opposition to the optical nature of the flâneur. As a digital curator, who produces bits of information, we see the parallelism maintained⁵.

4. **Collecting as Study:** The idea that collecting is a primal phenomenon of study suggests that the act of collecting is not merely about accumulating physical objects but is a form of acquiring and organising knowledge. The digital curator, like a collector, gathers information and creates a system of understanding⁶.
5. **Struggle Against Dispersion:** a hidden motive of collecting emerges. A seminal struggle against dispersion looms in the digital⁷.

Tracing the everlasting amazement of visual culture, from historical cabinets of curiosities to the digital age, one encounters a fundamental human inclination towards wonder. The digital archive, which was born from the *Wunderkammer* tradition, functions as a witness to the enduring fascination with the extraordinary. Wonder, a response to novelty, acts as a catalyst for learning and exploration, and stimulates the continuously evolving environment of visual culture. As

³ "What is decisive in collecting is that the object is detached from all its original functions in order to enter into the closest conceivable relation to things of the same kind. This relation is the diametric opposite of any utility, and falls into the peculiar category of completeness." (Benjamin, 1999: H1a, 2)

⁴ "But this is the way things are for the great collector. They strike him." (Benjamin, 1999: H1a, 5)

⁵ "Possession and having are allied with the tactile, and stand in a certain opposition to the optical. Collectors are beings with tactile instincts.[...], *Flâneur, The flâneur, optical; the collector tactile.*" (Benjamin, 1999: H2, 5)

⁶ "Collecting is a primal phenomenon of study: the student collects knowledge." (Benjamin, 1999: H4, 3)

⁷ "Perhaps the most deeply hidden motive of the person who collects can be described this way: he takes up the struggle against dispersion." (Benjamin, 1999: H4a, 1)

one navigates the digital landscape, the necessity of wonder remains a conducting force, shaping the understanding of the past, of the present, and giving an indication of things to

come: the openness of the possibilities of the future. In the labyrinth of human existence, where the threads of memory and wonder are combined, humans collect.

The Cultural Heritage in the Age of Digital Reproducibility

The Authenticity of Digital Replicas

Paolo Clini, Renato Angeloni

In today's digital age, the integration of digital technology and cultural heritage has led to profound transformations in how we perceive and experience it. Moreover, within our increasingly interconnected global society, the historical knowledge and cultural significance embedded in cultural heritage have become essential for maintaining cultural diversity and sense of place. Whether it encompasses historical landmarks, artifacts, traditions, languages, or cultural practices, each facet contributes to preserving the richness of communities, providing a connection to their roots, and fostering a sense of belonging and continuity with the past and the places they inhabit. This innate need to relate to the past may not be as vital as basic human needs such as housing, food, sanitation, or public health, but it is nonetheless crucial for sustaining life, as evidenced by the inclusion of cultural access among essential human rights (United Nations, 1949).

Embracing technological innovations in the management of cultural heritage offers numerous opportunities for engaging communities and fostering a deeper connection with their history (European Commission, 2023). By leveraging digital tools, cultural heritage organizations can create diverse and inclusive experiences tailored to a wide range of audiences. From virtual exhibitions and interactive installations to digital storytelling platforms, digital heritage initiatives hold the promise of sparking meaningful dialogues within communities about their shared past and its relevance in contemporary times. Furthermore, using digital replicas, cultural heritage can transcend geographical and cultural barriers, reaching global audiences and facilitating new forms of engagement compared to the original objects. The interaction with digital objects differs from that with physical ones, raising fundamental inquiries into the concept of authenticity when experiencing cultural heritage through digital replicas (Di Giuseppantonio Di Franco et al, 2018).

Contemporary dialogues on the impact of multimedia technologies on museums, archaeology, and heritage often presume a contrast between the virtual and physical realms, articulated through various dichotomies. The physical world carries significance—weight, aura, evidence, the passage of time, the signs of power through accumulation, authority, knowledge, and privilege. In contrast, replicas are often perceived as diametrically opposed—immediate, superficial, temporary, modern, popular, and democratic. This discourse highlights a dichotomy between original (authentic) artifacts and their inauthentic replicas (Witcomb, 2010). Materialist perspectives have traditionally dominated discussions on the authenticity of replicated heritage objects, with the creation of digital replicas seen as the next step in reproduction technologies after mechanical reproduction (Muller, 2017). Consequently, the authenticity of digital replicas is often compared to that of physical replicas. Debates surrounding physical replication often circle back to Walter Benjamin's seminal essay, "The Work of Art in the Age of Mechanical Reproduction" (1936). Benjamin argues that even the most flawless reproduction lacks the inherent authenticity of an original object. He suggests that an object's authenticity resides in its unique history, encompassing its substantive duration and its testimony to the experiences it has undergone—a quality beyond reproducibility. Con-

trary to Benjamin's materialistic theories, Latour and Lowe (2011) argue that aura is not lost through replication. They claim that advanced technologies can instill replicas with a degree of the original object's aura and authenticity. According to them, the key lies in the quality of the replica, particularly the precision of the final product, which enables it to be comprehended and revered. They even suggest that replication might enhance the aura surrounding the original, challenging the notion of authenticity as intrinsically linked to the original object. According to them, the crucial factor lies in the quality of the replica, especially the accuracy of the final product, which allows it to be fully understood and respected. In fact, they argue that replication may even enhance the aura surrounding the original, thereby challenging the notion of authenticity being inherently linked solely to the original object.

Following these theories, in recent times, there has been a significant focus on the authenticity of digital replicas, particularly concerning their accuracy, resolution, and aesthetics. However, while ensuring the accuracy of these replicas is crucial, solely prioritizing precise reproduction can lead to technological fetishism. It is imperative to also consider the new insights that a digital replica of a cultural object can provide about the original. These insights have the potential to yield novel understandings and connections with

communities, thereby fostering innovative forms of authenticity for the replicas that were absent in the original. Indeed, digital replicas enable individuals to interact with them in ways that the original artifacts could not facilitate. These novel forms of interaction, supported by digital tools, are arguably authentic. Therefore, the authenticity attributed to replicas should not solely depend on the replica itself but also on its ability to generate authentic experiences (Jeffrey, 2015).

While the questions surrounding the authenticity of digital replicas may be complex, they can be grounded in a simple principle: the original concept of heritage digitization, which underlies the generation of digital replicas. At its core, heritage digitization aims to preserve, document, and make cultural contents accessible. It is noteworthy that The London Charter (2009) outlines principles for the documentation, interpretation, and dissemination of cultural heritage using computer-based visualizations while avoiding the term 'authenticity', possibly due to its potential for misleading interpretations (Hermon & Niccolucci, 2018). Defining an object in terms of authenticity may imply that it is the real and undisputed entity, contrasting with anything fake or copied. Conversely, adherence to The London Charter ensures that replicas are considered 'authentic' copies, meaning they are accurate and trustworthy, grounded in factual information. Such

information is meticulously documented to uphold the intellectual integrity of the scientific research supporting the creation of the digital artifact, along with ensuring data transparency. The principles outlined in The London Charter were specifically designed to ensure that these two aspects are consistently considered whenever computer-based visualization is employed in cultural heritage studies. As a result, the quality of the visualization output can be quantitatively assessed, considering factors such as pixel count, point cloud density, scan quantity, environmental conditions, and more. This allows each researcher to establish their own criteria for determining whether the result is authentic or not. However, this level of precision does not inherently impact the concept of 'authenticity' as long as it is transparently reported and documented. What is considered 'authentic' for communication purposes may not necessarily hold the same authenticity when scientific analysis is involved. Adherence to The London Charter provides the necessary information for any subsequent researcher to evaluate whether the digital replica in question meets the threshold of being 'sufficiently authentic' for its intended re-use.

In conclusion, the advent of digital replicas marks a transformative moment in the dissemination of cultural heritage, surpassing any previous scale in human history. Drawing parallels to Benjamin's

time, the introduction of photography foreshadowed similar advancements, evoking concerns about the potential loss of intangible quality with the ease of image reproduction. However, hindsight reveals that the mass reproduction of art is not as ominous as initially feared by Benjamin. Instead, it presents a multitude of opportunities for cultural institutions to navigate. As digitization professionals, it is imperative to focus on the authenticity of the copy, intended as its measurable correspondences with the original object. This entails ensuring that the digital

replica fulfills the specific authenticity requirements dictated by the intended purposes of use. The central challenge facing cultural institutions lies instead in effectively navigate the complexities and opportunities presented by digital technologies, promoting authentic cultural experiences of digital replicas. Museums and other cultural sites have the potential to lead the way into the future by transcending historical constraints and embracing innovation, shaping the future of heritage preservation and dissemination in the age of digital reproducibility.

Photography's Role in Digital Curation

Preserving Cultural Heritage: Unveiling Narratives and Shaping Futures through Photographic Curation

Isabel Dantas dos Reis

Digital curation—which involves selecting, preserving, maintaining, collecting, and archiving material via digital means to ensure long-term accessibility and usability—plays a pivotal role in preserving cultural heritage. It also helps democratise the process by providing public access to digital collections, as clearly emphasised in Nancy Proctor's work on digital museum practices (Proctor, 2010).

As a compelling visual representation medium, photography specifically plays a pivotal and multifaceted role with respect to digital curation: encompassing complex processes involved in digital asset selection, preservation, maintenance, and presentation. Photography is necessary for documenting and preserving cultural heritage objects and artefacts in digital archives and museums to ensure long-term preservation for future generations. Unavoidably,

one has to acknowledge the medium's significance in documenting and preserving cultural heritage materials in digital repositories so a global audience can ultimately access and study them.

STORYTELLING, INTERPRETATION AND NEW TECHNOLOGIES

Building on insights shared by Higgins (2011), visual narratives constructed by photography weave a contextual tapestry that massively aids one's ability to understand cultural and historical backgrounds. Curators thus strategically use photographs to unravel the stories behind artefacts and exhibits, boosting engagement and education and providing a means to convey relevant context and information. Consider a historical photograph of an archaeological dig site, essentially a portal to the narrative of an entire civilisation;

it's in this way that photography is a conduit connecting audiences to the past, enhancing cultural and historical relevance and thus playing an important role in storytelling and the interpretation of artefacts, peoples, and sites.

Photography has travelled a long way (technologically speaking) since Daguerre brought it into the world in 1839. Pixel-made digital images have since replaced those silver-made daguerreotypes, and digital technology advancements have profoundly influenced photographic curation: revolutionising how we capture, manage, and disseminate visual content. From the advent of digital cameras to the development of sophisticated image-processing algorithms, these innovations have democratised access to photography while empowering individuals/institutions to engage with visual materials in unprecedented ways. High-resolution images, meanwhile, allow us to capture the finest details and nuances to enhance the quality and fidelity of digital reproductions. Image-recognition algorithms, which automate the process of tagging and categorising photographs, streamline the curation workflow and improve search/retrieval functionalities in digital repositories.

In his digital library system and metadata management research, Giarlo (2005) discusses the impact digital technologies have on photographic curation practices: sharing insights under-

scoring the transformative potential of digital technologies with respect to expanding the scope and capabilities of photographic curation and how this paves the way for more efficient/effective digital collection management.

These innovations, very much key for digital curation, have a powerful ability to democratise image creation/access. Three-dimensional (3D) imaging technologies, specifically, allow for a full-throttled cultural heritage experience that gives users the ability to explore and interact with this material in virtual environments. Virtual reality (VR) platforms also enable users to immerse themselves in digital collections as they navigate and engage/interact with this content. Clearly, the combination of digital humanities with innovative use of photography in digital curation enhances user engagement and facilitates access to digital collections.

PHOTOGRAPHIC CROWDSOURCING

Crowd-sourced photography initiatives call on the public to help document and curate photographic materials, inviting communities to come together and collaborate as part of this digital push.

Leaning on volunteers and enthusiasts to document, curate, and annotate photographic content in digital repositories, photographic crowdsourcing is a powerful approach here: giving diverse individuals the chance to blend their

knowledge, expertise, and experiences and thus inject unique perspectives/insights into digital collections. From tagged and categorised photographs to transcribed handwritten annotations and identified historical landmarks, crowdsourced contributions make it easier to discover, access, and interpret photographic materials in digital repositories.

One big advantage of photographic crowdsourcing is that its scalability/flexibility gives digital repositories the ability to tap into the collective wisdom/expertise of volunteers from all corners of the globe. These initiatives can in fact mobilise thousands of participants who are eager to contribute to the curation of large-scale photographic collections, seeing rapid progress and the comprehensive coverage of diverse topics/themes in return. Moreover, crowdsourcing encourages community engagement and empowerment as individuals actively seek to preserve and share cultural heritage materials most meaningful to them. Crowdsourcing initiatives can play out across various forms ranging from structured tasks and workflows to open-ended contributions and discussions.

Undoubtably, photographic crowdsourcing plays a pivotal role in digital curation, considering just how valuable the collective wisdom/expertise of volunteers is for enhancing the ability to access and interpret digital photo-

graphic collections. This is ultimately connected to the transformative potential of crowdsourcing, democratising access to cultural heritage materials and empowering individuals to actively engage in the curation and interpretation of photographic content.

Above all else, digital collections benefit from the unique perspectives and insights brought forth via crowdsourcing—with the collective wisdom/expertise of global participants shining through as a crucial resource. Photographic materials, meanwhile, are made more accessible, discoverable, and easier to digest for future generations in the process.

METADATA'S ROLE IN PHOTOGRAPHIC CONTENT CURATION

Metadata—which includes descriptive information such as titles, dates, creators, subjects, and keywords as well as technical details such as file formats, resolutions, and dimensions—provides context essential to understand and interpret visual materials in digital collections (playing a crucial role in photographic content curation in return). Linking this information to photographic material, meanwhile, aids search, access, and retrieval processes for relevant content in digital repositories.

Anna Bentkowska-Kafel (2017) speaks to this topic in her research on digital

imaging and cultural heritage preservation, highlighting the importance of metadata for organizing and describing photographic materials in these digital spaces. She specifically emphasises how metadata gives context to photographic content to aid interpretation and analysis among researchers, scholars, and the general public as well: with these insights speaking to the significance of metadata in photographic content curation and its impact on the accessibility/usability of digital collections.

CHALLENGES, OPPORTUNITIES AND ETHICAL CONSIDERATIONS

As discussed above, while photography offers numerous opportunities to document and preserve visual information in digital collections, it also presents various challenges such as copyright and metadata management. While the former is a looming concern as photographs are often subject to copyright restrictions governing their use and reproduction, the latter plays a crucial role in organising/describing photographic materials in large digital collections—so often plagued by difficulties regarding practical ways to create/maintain accurate and comprehensive metadata given their breadth.

In her work on engagement with digital archives, Sarah Saunders (2022) discusses the aforementioned challenges with respect to digital curation: high-

lighting the importance of properly addressing these to ensure one can access/utilise photographic materials in digital collections on a long-term basis. By and large, these insights emphasise complexities involved with managing photographic content in digital repositories and the need for effective strategies to overcome these challenges.

Ethical considerations are of course extremely important when photographing and curating sensitive or culturally significant subjects in digital collections. Privacy, consent, and representation, for example, rank among key ethical issues; not only is it essential to gain consent from individuals shown in photographs while respecting their privacy and cultural sensitivities, but representation dictates the ethical use of photography as images have the power to shape perceptions and narratives whether with respect to individuals, communities, and/or cultures.

Rollason-Cass and Scott Reed (2015) discuss this same topic in their research on digital curation and archival practices, speaking to the importance of obtaining consent and respecting the privacy and cultural sensitivities of people depicted in photographs. They also touch on the role of representation in shaping narratives and perceptions about diverse communities/cultures, highlighting the need for an ethical approach when curating photographic content in digital repositories and the

importance of upholding ethical principles in all aspects of this (particularly with respect to the sensitive nature of the material).

COLLABORATION FOR EFFECTIVE DIGITAL CURATION

Digital curation that involves any sort of photography calls for collaboration melding diverse perspectives, expertise, and resources to both address complex challenges and achieve set goals. By inspiring an interdisciplinary alliance between photographers, archivists, curators, technologists, and other stakeholders, these initiatives can make great use of this collective knowledge to enhance the quality and overall impact of digital collections. Stakeholders, thus, can pool their expertise and resources, share best practices, and develop innovative solutions to common challenges. As the old saying goes, teamwork really does make the dream work. This emphasises just how valuable teamwork is when addressing the many challenges involved with managing photographic content in digital repositories, highlighting the need for collaborative approaches to digital curation. In this environment, stakeholders can work together to ensure the long-term preservation and accessibility of photographic materials (with future generations set to benefit).

IN SUMMARY

As a medium that's truly a universal language transcending barriers with

respect to time, culture, and geography, photography (and its crucial role in digital curation) is a powerful tool for documenting, preserving, and sharing one's visual heritage in the digital age. From the earliest daguerreotypes that captured fleeting moments in history to the vast repositories of digital images that now document contemporary life as we know it, photography continues to shape our understanding of the world we're a part of.

The rise of digital technologies, meanwhile, has completely shifted how we engage with photographic content: carving out fresh opportunities for exploration and interaction. Offering interactive online exhibitions, immersive VR experiences, etc., digital curation platforms give us the chance to engage with photographic materials in ways once deemed unimaginable. Not only do these technological advancements enhance digital collection accessibility/usability, but they also democratise access to cultural heritage materials so a global audience—regardless of location or socioeconomic status—can enjoy them.

Zooming out, photography's role in digital curation isn't just about preserving visual materials; it's about working in tandem to document, interpret, and celebrate human culture and history. We can therefore continue to capitalise on the transformative potential of this medium within the digital space by committing ourselves to excellence, innovation, and ethical stewardship in this regard: better understanding the past and the present while inspiring the future.

Digitalisation and Sustainability

Crafting Green Futures for Cultural Institutions

Romina Nespeca, Alessandra Frontini

DIGITAL TRANSFORMATION OF CULTURAL AND CREATIVE INSTITUTIONS

The Cultural and Creative Sectors (CCS) have been severely impacted since the onset of the Covid-19 pandemic. Even prior to this, CCS institutions grappled with addressing the vulnerabilities inherent in this sector. However, for many, the current circumstances have rendered it nearly impossible to sustain their activities. Cultural institutions, particularly museums, have encountered significant hurdles in recent years, enduring prolonged closures or severely restricted access due to social distancing measures (Clini and Quattrini, 2020). The inability to fully engage with the physical aspects of Cultural Heritage has prompted intensified efforts to transition cultural experiences, products, and services into online formats (OSSERVATORI Observatory for Digital Innovation in Cultural Heritage and Activities, 2021) (NEMO Network

of European Museum Organisations, 2020).

Upon the resurgence of physical museum attendance, some museums may mistakenly perceive this as a signal that digital tools are now less significant, rather than recognizing the potential to strike a balance between digital and physical experiences moving forward (Debono, 2021). The digital revolution has ushered in a new era of museum practices, with digital curation emerging as one of the most groundbreaking aspects. This shift has given rise to a new array of cultural encounters, as individuals engage with both physical and virtual realms via social media platforms or “phygital” museum exhibitions (Banfi et al., 2023).

The notion of digitally transforming museums is closely tied to the term “digitalization.” This isn’t merely about putting museums on the internet; it involves leveraging digital technologies

and strategies to enrich visitor experiences, engage audiences, improve collection accessibility, and streamline back-office management. To clarify this concept, it's helpful to distinguish between two interconnected yet distinct processes: "digitization" and "digitalization." Digitization entails converting analogue materials into digital formats, whereas digitalization entails using digital technologies to reshape a business model and create new avenues for generating revenue and value. While these terms and their distinctions were initially debated in economics (Gobble, 2018) and examined through technological trends, contemporary literature in the cultural heritage domain has begun to spotlight various examples that delineate diverse approaches to digitalization processes. Furthermore, recent research has shed light on how existing or accessible digital skills influence decision-making processes regarding technology deployment (Clini et al., 2019) (Cori and Fraticelli, 2021). This digital transformation entails integrating technology into all facets of museum operations, spanning curation, exhibition design, visitor engagement, and marketing (Park et al., 2021).

Digital transformation represents a profound shift in an organization's framework, enabling it to not only adapt but thrive in the internet era. Central to delineating strategies is the ability to assess and comprehend the

level of digital maturity within GLAM institutions (Galleries, Libraries, Archives and Museums). Digital maturity is characterized as an individual's or organization's capacity to effectively utilize, manage, create, and comprehend digital technologies in a manner that is both contextual and purposeful (Finis et al., 2020). Consequently, self-assessment has become a crucial methodology for evaluating an organization's digital maturity and its readiness to adopt technologies and organizational innovations aligned with its management model.

Indeed, as digital institutions mature, their focus should be on integrating digital technologies—such as social media, mobile applications, analytics, and cloud computing—to fundamentally reshape how their operations function. In fact, it's the strategic approach, rather than the technology itself, that propels digital transformation forward (Kane et al., 2015). Considering this, it's evident that one of the primary catalysts for digital transformation in GLAM institutions is the growing demand for both online and on-site digital experiences. With more individuals relying on digital platforms for information and entertainment, institutions recognize the imperative to adapt to this evolving landscape to remain pertinent and accessible to their audiences (Taormina and Baraldi, 2022).

SUSTAINABILITY IS ALSO CULTURAL

On the other hand, climate change and environmental degradation stand as formidable challenges of our era, posing threats to both Europe and the global community. The European Union (EU) is actively addressing these challenges, spearheading efforts to become the world's first climate-neutral continent. This commitment extends to the realm of cultural heritage. Sustainability stands as one of the key pillars within the Framework for Action on Cultural Heritage, underscoring its potential to bolster social capital, drive economic progress, and ensure environmental sustainability. Leveraging culture and cultural heritage can play a pivotal role in achieving inclusive and sustainable development. Specifically, the Framework outlines three key clusters of actions aimed at: regenerate cities and regions through cultural heritage; promote adaptive re-use of heritage buildings; balance access to cultural heritage with sustainable cultural tourism and natural heritage (European Commission, 2019).

Cultural sustainability has become a growing priority within sustainable development agendas, and is now often depicted as a fourth pillar, equal to social, economic, and environmental concerns (Loach et al., 2017). It is a concept that refers to the ability of a community, society, or civilization to preserve, protect, and promote its culture over the long term. It involves ensuring that

cultural practices, traditions, languages, arts, and creative expressions can continue to exist and thrive over time, without suffering irreparable damage or significant loss.

A study investigates the scientific discourse on cultural sustainability by analysing the diverse meanings that are applied to the concept in scientific publications. The analysis shows that the cultural sustainability is organized around seven storylines: heritage, vitality, economic viability, diversity, locality, eco-cultural resilience, and eco-cultural civilization. The latter suggests culture as a necessary foundation for the transition to a truly sustainable society (Soini and Birkeland, 2014).

Cultural sustainability also involves respecting and valuing cultural diversity, promoting the active participation of local communities in decision-making on cultural issues, and creating policies that protect and sustain cultural heritage. About it, (Li et al., 2021) delivers significant implications to the tourism policymakers and practitioners on how sustainable tourism development should be planned and operated to secure a long-term benefit especially focused on how the local community should be involved in the overall development process.

In addition, cultural sustainability is often intertwined with other aspects of sustainability, such as environmental and social sustainability. For example,

preserving traditional cultural practices can contribute to the preservation of the natural environment and foster a sense of belonging and social cohesion within communities. Certain studies have discussed the relationship between cultural sustainability and its potential to yield economic, social, and environmental advantages. Meanwhile, others have emphasized how adhering to the fundamental principles of sustainability can assist museums in fulfilling their central cultural objectives. (Pop et al., 2019) shows that the ability of museums to reach cultural sustainability is influenced by components of their social and economic performance, while environmental behaviour proved to be insignificant.

SUSTAINABLE OPPORTUNITIES BY DIGITALIZATION

In the field of cultural heritage, the relationship between sustainability and digitalization can be highly fruitful and significant. Here are some ways in which digitalization can contribute to the sustainability of cultural heritage:

- Digital preservation/conservation;
- Accessibility and enjoyment;
- Education and awareness;
- Management and monitoring.

Digitalization enables the preservation and reproduction of artworks,

historical artifacts, documents, and other elements of cultural heritage in digital formats. This contributes to sustainable conservation practices by reducing the need to physically handle or exhibit cultural artifacts. This can be crucial for protecting heritage from damage, deterioration, or loss, allowing permanent and universal access to cultural works without wearing out the original materials. For example, creating high-resolution 3D models enables scholars to examine details and structures without harming the original objects, thus reducing the risk of physical damage. Furthermore, digitization allows for the preservation and enjoyment of artworks, historical artifacts, and documents without the need for physical resources such as paper, ink, display materials, or energy for exhibition lighting. This approach reduces resource consumption and contributes to environmental sustainability.

Digitalization makes cultural heritage accessible to a wider audience, including those who cannot physically visit sites or artworks. For example, digital museums allow people to explore collections from around the world without the need for travel, contributing to greater democratization of access to culture. From an environmental perspective, this can reduce carbon emissions associated with travel and transportation required to physically visit cultural sites.

Digital technologies provide interactive tools and engaging experiences to educate the public about cultural heritage and raise awareness of its importance. Through online platforms, educational apps, virtual tours, and augmented reality projects, it's possible to create immersive learning experiences that stimulate interest and awareness of cultural heritage. Similarly, they can be an effective educational tool to raise public awareness about environmental issues and the need to preserve the natural environment. Through educational projects and immersive virtual experiences, it's possible to highlight the connections between cultural heritage and the environment, promoting greater awareness of the importance of sustainability in all its aspects.

Digital technologies such as georeferencing, geographic information systems, and augmented reality can be utilized for the management and monitoring of archaeological sites, historical monuments, and cultural resources in general. This contributes to better planning of conservation activities and effective protection of cultural heritage from threats such as environmental degradation and vandalism. This also includes monitoring actions of visitor behaviour, for example within museum spaces, which are very useful for user profiling and satisfaction verification, with the advantage of increasing public engagement.

THE DARK SIDE OF DIGITISATION

As described, the digitalization of cultural assets has numerous positive implications for their preservation and promotion, ensuring access to a wider audience beyond the locations where they are physically preserved. However, this "race towards digitalization" that we are witnessing also has an impact on the ecosystem of our planet Earth, and museums should be aware of this: not so much to avoid or limit it, but rather to counterbalance its effects.

A study by Nanjing University of Information Science & Technology published in March 2023 reports that "the Internet would rank as the sixth most polluting country in the world if it were a nation" (Than Oo et al., 2023). Increasingly, studies are showing how networks and data centers require electricity to store and share information, as well as constant cooling, resulting in what is termed an "ecological footprint" or an impact on water and soil. In 2030, data centres are estimated to account for more than 3% of electricity consumption in Europe (Avgerinou et al., 2017; Directorate-General for Energy, 2024).

The massive infrastructure that the Internet requires to function is often overlooked. This includes data centres, servers, submarine fiber optic cables, relay antennas, Wi-Fi routers, and much more. All these components work together to process every online activity that end-users perform. Within

the study from Nanchino University, it is highlighted that the total global CO₂ emissions from the “Internet Nation” are 66% attributed to the use of technological devices, 19% from the network, and 15% from data centres (Bordage, 2019).

To give an idea of the quantity of digitized assets within museums, consider that the Metropolitan Museum of Art in New York alone provides free access to 240,000 artworks and 409,000 images under a Creative Commons license. In Italy, the information systems managed by the Central Institutes of the Ministry of Culture contain over 37 million catalogue descriptions associated with approximately 26 million images (Ministry of Culture, 2022).

Enormous databases are needed, whose main challenge now lies in networking, moving away from data silos, i.e., those independent and self-contained vertical systems, towards a common distributed and global infrastructure. For this reason, the European Commission will invest €110 million by 2025 to fund projects aimed at creating a collaborative cloud infrastructure. This is an excellent measure to ensure access to utilization since, in general, 55% of data produced by organizations is only used once (Jackson and Hodgkinson 2022), implying that a large amount of stored data may prove to be of little use. The next phase after this optimization of resources should be to calculate its

ecological footprint to implement compensatory measures.

In addition, as evidenced by direct experiences, the lack of operators training, technological obsolescence, and the lack of continuous maintenance are among the main and most frequent causes of the failure of digital user experiences, turning opportunities for cultural sustainability into unsustainable investments. As some surveys show, the staff is often insufficient and untrained, and digital design often lacks management and maintenance plans both in the short and long term.

OPEN CONCLUSIONS

The digital transition of Cultural and Creative Institutions represents a complex process that offers both opportunities and challenges. On one hand, digitalization allows for more effective preservation of cultural heritage, improved accessibility to cultural resources, facilitation of education and public awareness, and optimization of management and monitoring processes. Digitalization enables cultural institutions to broaden their scope and reach a wider audience, making cultural collections inclusive. It can be stated that digitalization enhances and fosters cultural sustainability, defined as the maintenance and promotion of cultural diversity and human creativity.

However, the rapid advancement towards digitalization also raises concerns about its impact on environmental sustainability. Recent studies highlight the significant energy consumption and carbon emissions associated with digital infrastructure, such as networks and data centers. The vast amount of digital data and the infrastructure required to store and transmit it require a considerable amount of energy and natural resources, thereby contributing to the overall ecological footprint of digital activities.

To address these challenges, the European Commission has announced its intention to invest significantly in projects aimed at creating collaborative cloud infrastructure by 2025. This investment aims to promote greater collaboration and resource sharing among cultural and creative institutions, fostering increased accessibility and usability of digital data. In addition

to optimizing resources and adopting shared infrastructures, it is essential to assess and address the environmental footprint of digitalization itself. This involves not only understanding the energy consumption and carbon emissions associated with digital activities but also implementing measures to reduce the overall environmental impact.

In conclusion, the digitalization of cultural and creative institutions offers unprecedented opportunities for the preservation and dissemination of cultural heritage, but it requires a holistic approach that takes into account environmental impacts and long-term sustainability. The transition to a shared digital infrastructure is a step in the right direction, but it is necessary to continue evaluating and addressing the environmental challenges associated with digitalization to ensure sustainable development in the cultural and creative sector.

Digitization and Society

The Transformative Impact of Digitization on Society and Curation

Stanisa Peric

Digitization, the process of converting information into a digital format, has fundamentally changed society in recent decades. This transformation has had profound consequences for how we access, consume, and interact with information. One area where the impact of digitization is particularly evident is in curation, the practice of selecting, organizing, and presenting collections of artifacts. This essay explores how digitization is changing society, its consequences for curation, the opportunities it presents, and the evolving role of the curator in this digital landscape.

DIGITIZATION AND SOCIETY

Digitization has revolutionized how we communicate, access information, and conduct business. The internet, a product of digitization, has become an integral part of daily life, connecting people across the globe and enabling instant

communication. This interconnectedness has facilitated the rapid spread of information and ideas, transforming the way we learn, work, and socialize.

One of the key consequences of digitization is the democratization of information. The internet has made vast amounts of information accessible to anyone with an internet connection, breaking down traditional barriers to knowledge. This has empowered individuals to become creators and curators of content, challenging the authority of traditional institutions such as libraries and museums.

Another consequence of digitization is the digitization of cultural heritage. Museums, libraries, and archives are digitizing their collections, making them accessible to a global audience. This has the potential to democratize access to culture and history, allowing people to explore diverse perspectives and narratives. However, it also raises

concerns about the preservation of digital artifacts and the potential loss of physical objects.

CONSEQUENCES FOR CURATION

The digitization of information has had profound consequences for curation. Digital technologies have enabled curators to create immersive and interactive experiences, enhancing the engagement of audiences. Virtual and augmented reality, for example, can bring history and art to life in ways previously unimaginable.

Digitization has also expanded the scope of curation, allowing curators to curate digital content alongside physical artifacts. This has enabled curators to reach a broader audience and engage with people who may not have access to physical collections.

However, digitization has also raised challenges for curation. The sheer volume of digital information available can be overwhelming, making it difficult for curators to sift through and select relevant content. Additionally, the ephemeral nature of digital content poses challenges for preservation, as digital artifacts are susceptible to loss or degradation over time.

OPPORTUNITIES OF DIGITIZATION

Despite these challenges, digitization presents exciting opportunities for

curation. Digital technologies can enhance the curation process, allowing curators to organize and present information in innovative ways. For example, digital tools such as metadata tagging and content management systems can help curators categorize and organize digital content more effectively.

Digitization also enables curators to collaborate across borders, facilitating the exchange of ideas and resources on a global scale. Digital platforms such as online forums and social media allow curators to engage with audiences in new ways, fostering a sense of community and participation.

Furthermore, digitization can enhance the accessibility of cultural heritage, making it available to people who may not have had access otherwise. This can help to promote inclusivity and diversity in cultural institutions, ensuring that a wider range of voices and perspectives are represented.

CHANGING ROLE OF THE CURATOR

The role of the curator is evolving in response to digitization. Curators must now possess a diverse set of skills, including digital literacy, data analysis, and digital storytelling. Curators must also be adept at using digital tools and technologies to enhance their curation practices.

The changing role of the curator also

extends to how they engage with audiences. Curators must now be more proactive in reaching out to audiences, using digital platforms to create engaging and interactive experiences. This requires curators to be more accessible and transparent, engaging with audiences in a two-way dialogue rather than simply presenting information.

In conclusion, digitization is reshaping society in profound ways, impacting how we access, consume, and interact with information. This transformation

has significant consequences for curation, presenting both challenges and opportunities. While digitization has democratized access to information and cultural heritage, it has also raised questions about the preservation and reliability of digital artifacts. The evolving role of the curator in this digital landscape requires adaptability and innovation, as curators seek to harness the power of digitization to create meaningful and engaging experiences for audiences.

The Digital Transformation of Curation

SWOT analysis

Andjela Djordjevic

In contemporary world digitization has entered every pore of society. On the one hand, slowly but surely, and on the other hand instantly. Fast technology, modern gadgets and services are currently omnipresent. Can anyone just imagine the world without their faithful companions: the mobile phones? They have somehow become an integral part of our bodies and we seldom go anywhere without them. We use them for everything, from everyday communication to online shopping or watching TV series. Digitization is rapidly transforming our lives and the world we live in. Baring that in mind, it is quite obvious that this process, not only will have its effect on curation in the future but has already ignited the flame of rapid transformation. Museums and curators are not immune to these changes and the process of digital transformation has certainly started a (r)evolution of its own kind in this field. This essay intends to reflect on the prominent strengths, weaknesses, opportunities and threats digitization process brings to contemporary museums and curation.

There are many strengths digital transformation brings to curation, two of which would be elaborated in this paragraph. The outburst of the corona virus epidemics several years ago did not only accelerate the digitization process but has also emphasized the necessity of it. The digitalization process enabled virtual tours in the most popular museums when it was impossible to visit them in person. Even though they were not physically present, people were able to enjoy art and explore cultural heritage by simply using a gadget connected to the internet. Nowadays, with the epidemics finally behind us, having access to virtual tours and being able to explore items of artistic or cultural significance, presents a great opportunity for everyone around the world to learn, conduct research or simply enjoy the museum experience. Therefore, it can easily be concluded that one of the greatest strengths the digitalization process brings curation is accessibility. Further, museums can have great benefits from the digitization process, not only by increasing accessibility, but

also by preserving valuable pieces of art or cultural heritage in digital form. The task of preservation is a highly important one and must be treated as such. Here, digital transformation comes to be of aid since items and all the pieces of information about them can be digitally stored and preserved for the generations to come. Also, digital versions of some physically sensitive pieces of art or cultural heritage items and places (such as Pompei, for example) could be utilized for exhibitions or virtual tours in order to prevent damage or complete destruction of these valuable remnants of the past.

On the other hand, there are some weaknesses that would require improvement over the course of digital transformation. Firstly, one of the greatest weaknesses lies in the fact that digitized version of a piece of art, no matter how well made and by which technology, could never match the genuine energy of the original. Imagine standing in front of "The kiss" by Gustav Klimt in "Österreichische Galerie Belvedere Museum" in Vienna, watching the gold leaves creating the magic in that one moment of eternity captured in a single painting and the whole crowd standing in awe by its beauty. This kind of atmosphere is almost impossible to capture in a digital form. Also, this leads us to another weakness: loss of connection, and by this term I do not refer to the internet connection. Museums and other cultural places are almost

always filled with people. As humans, it is our essential need to connect to each other, and nothing can replace being surrounded by visitors and talking to actual curators. Curators' responsibility is not only to acquire the items and develop a collection for an exhibition, but also to enhance the tour experience by interpreting a certain item and giving important pieces of information to the visitors. Even though information is usually available in the digitized version of an item, the process of interpreting a piece is unique for each curator and interesting dialogues could be lead between curators and visitors during the real tour. Finally, in order to complete the process of digital transformation, adequate infrastructure must be provided, which can lead to additional financial costs for the museums.

However, the opportunities digitization process brings to curation easily overshadow potential flaws and weaknesses. First of all, enhanced accessibility of digital content opens the door to reaching a global audience. Regardless of how geographically far a country is from a certain cultural sight, individuals, no matter of their financial situation, can enjoy and explore it by simply connecting to the internet. This gives the young students the opportunity for cultural exchange and possibilities for achieving great broad education by examining and comparing cultural items and pieces of art from all around the world. Further, museums can have

great benefits from tracking user experience. This is specially made easy with the digitization, since various tracking methods could be applied to gain genuine feedback on user experience. Therefore, digital transformation of curation can be used to give an individual the opportunity of enjoying personalized content, depending on their interests. Finally, the new technologies such as augmented and virtual reality enable immersive experience and a unique way of reaching new audiences. This is also supported by numerous new headsets entering the market, such as Apple Vision Pro and Google Quest, among others. This hardware gives the opportunity to software engineers to design new applications focusing on digital museums and virtual tours. By implementing AR and VR in a museum tour, curators can create not only interactive content to engage visitors, but also captivate their complete attention by engaging all their senses and letting them dive into immersive museum experience creating strong sense of presence.

Nevertheless, one must be aware of certain risks and threats the digital world hides within. Digital items are vulnerable to cyber-attacks. This can be a particularly sensitive topic since, nowadays, almost all virtual platforms collect data and information about the users to improve user experience. Unfortunately, even though this gives the opportunity to create personalized

content for users, a question of data privacy arises. No one could guarantee whether hackers would attack and steal the data and use it maleficiently. Also, the issue of copyright must also be considered, especially when the curated material is available online. This issue even arises when legal software is used. We are all aware of the possibilities DALL·E offers to its users: one could create digital artworks grounded on the combination of already existing art. This has raised controversy among the artists who argue that this software, even though it generates new art, uses the existing works in the process without permissions or financial compensation. Considering these statements, digital items must be carefully and well protected in order to prevent their stealth or alteration. This process, though necessary, can be time-consuming and quite often requires employing qualified staff, which comes with additional financial costs.

To conclude, the process of digitization has already had a dramatic impact on every aspect of our lives, including cultural institutions such as museums. This process brings many strengths and new opportunities for modern society and future generations, such as preservation of the items of cultural or artistic significance and increased accessibility, which further enables global reach and cultural exchange. However, one must be aware of the weaknesses and, even more importantly the threats

which rise along the way. Virtual reality simply cannot recreate the atmosphere of a real museum. Also, the main threat the content digitally curated faces is the stealth of data and its potential alteration. Also, the rise of artificial intelligence can lead to the unlicensed utilization of the digital material to create new content without permission or financial compensation. If we look at the irony, even while writing this essay we can use modern technology to give us a hand. In fact, artificial intelligence

could easily be used to write the whole thing instead of us. Considering that, one cannot bear but wonder where would humans be, and which jobs would be left for us? One thing we surely still have is critical thinking and having virtual access to some of the most valued museums and being able to examine the items of high cultural importance could not only warm our hearts, but also sharpen our thoughts and enlighten our minds. After all, beauty, art and culture do have the power to save the world.

Embracing the Opportunities of Digitization

The Changing Role of Curators in the Digital Age

Olivera Nikolic

In today's rapidly evolving digital landscape, the opportunities presented by digitization are vast and transformative. One significant area experiencing profound change is the role of curators. Traditionally associated with museums, galleries, and libraries, curators are now navigating a digital realm where access to information is virtually limitless. This essay explores the opportunities digitization brings and examines how curators are adapting their roles to thrive in this digital age.

Museums are closed cultural institutions, and in fact they are and should be data banks. This claim refers to the slow and incomplete availability of information about the cultural assets they care for, both for the general public and for employees. Curators of the same or different profiles rarely exchange their knowledge, even within the institution. Contemporary research

shows that only 5% of museum collections are presented to the public through permanent or temporary museum exhibitions (Corona, 2023). Some knowledge remains undiscovered for a long time because 95% of museum materials are stored in inventory books and warehouses. Digitization has the potential to unlock museums and improve the exchange of information and knowledge. With the goal of digitalization, the first projects were launched in America in the 60s of the 20th century, and the first milestone in this area was the establishment of the Museum Computer Network (MCN) in 1967, at the initiative of the Metropolitan Museum in New York (Pomigalov & Andreev, 2022). The International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM) has led the development of the Conceptual Reference Model (CRM), providing perhaps

the most complete model for describing concepts and relationships when documenting cultural heritage objects (Marty, Rayward, & Twidale, 2003). The CIDOC CRM is the culmination of over 10 years work by the CIDOC Documentation Standards Working Group and CIDOC CRM SIG which are working groups of CIDOC. Since 9/12/2006 it is official standard ISO 21127:2006 (The CIDOC Conceptual Reference Model (CRM), 2006). The actual version is Version 7.2.4 from February 2024. A turning point in the institutional action in the digitization of culture was achieved by the Recommendation of the Council of Europe on the Internet of Citizens, which was issued in February 2016. Its focus was on the modernization of cultural institutions, the empowerment of citizens as consumers and creators and fostering multi-literacies of education to access, create and manage digital culture (Council of Europe, 2016).

After all, the fastest understanding and acceptance of digitization within museums happened during the years of the Covid-19 pandemic. Covid-19 accelerated the digitization of museums and museum contents because it was the simplest and most acceptable way to maintain a connection with visitors. The analysis of museum contents, produced in recent years, proves that the possibilities of digitization in curation are wide and that it improves several areas.

ACCESSIBILITY OF INFORMATION - Digitization has democratized access to information, making vast repositories of knowledge available at our fingertips. Curators can leverage digital platforms to reach global audiences, breaking down geographical barriers that once limited access to cultural artifacts and collections. For example, Primus is a comprehensive collection management system for museums and cultural institutions. All or parts of the collection can be made available to the public through DigitaltMuseum (<https://digitaltmuseum.no>, <https://digitaltmuseum.se> and <https://digitaltmuseum.org>). More accessible to a wider audience is the Google Arts & Culture online platform, which features content from over 2,000 leading museums and archives that have partnered with the Google Cultural Institute. The service offers easily access to high-quality images, tour famous sites, exhibitions, articles, educational videos, and other cultural resources in partnership with many museums, cultural institutions, archives and arts organizations.

PRESERVATION AND CONSERVATION

- Digital technologies offer innovative solutions for preserving and conserving cultural heritage. Curators can digitize fragile artifacts, documents, and artworks, ensuring their long-term preservation while providing enhanced access for researchers and the public.

ENHANCED CURATION PRACTICES -

Digital tools enable curators to curate virtual exhibitions, expanding the possibilities for storytelling and engaging audiences in immersive experiences. Curators can utilize data analytics and AI technologies to gain insights into audience preferences, facilitating more personalized and impactful exhibitions.

COLLABORATIVE OPPORTUNITIES -

Digitization fosters collaboration among institutions, scholars, and artists worldwide. Curators can collaborate on digital projects, sharing resources, expertise, and collections to create richer and more diverse cultural experiences.

INNOVATION IN EDUCATION AND OUT-REACH -

Digital platforms offer new avenues for educational outreach, engaging audiences of all ages and backgrounds. Curators can develop interactive online resources, virtual tours, and educational programs, enriching learning experiences and fostering a deeper appreciation for culture and heritage.

The role of curators is undergoing a significant transformation in response to the digital revolution and shifting societal dynamics. Traditionally, curators have been responsible for acquiring, preserving, researching, and exhibiting cultural artifacts within physical spaces such as museums, galleries, and libraries. However, the proliferation of digital technologies and the changing expectations of audiences have

necessitated a reevaluation of the curator's role. Translated from the Latin language where curator means keeper, while curation means care, curator is, in the narrowest sense, the custodian and caretaker of the museum collection. The digitization of museum collections requires the curator's competence to take care of its digital copies and digital originals, as well as to know the ways of presentation of this type of heritage. As the curator is the link between the heritage and the audience, and as one of his roles is to convey inspiration and emotion through the organization of exhibition contents, digitalization must not diminish this tendency, but strengthen it. Key aspects of the changing role of curators occur in the domain of digital literacy, content curation, audience engagement, collaboration and partnership, ethical and legal considerations.

DIGITAL LITERACY - Curators must possess digital literacy skills to effectively navigate digital platforms, manage digital collections, and engage with online audiences. Continuous learning and professional development are essential as new technologies emerge, reshaping the digital landscape. Collaborating with the curators of various museums in Serbia on exhibition design, I noticed that they needed additional clarifications about AR and VR content, multimedia presentations, QR codes, animations, etc. It is necessary to explain to them how contents are created, how they are managed, on what devices they

are presented, so that they can prepare quality contents for presentation. For this reason, Digital Curator Training, as one of the results of the DCbox project, is necessary for the further understanding and renaming of digital technologies in museums.

CONTENT CURATION - Curators play a crucial role in curating digital content, selecting and organizing materials to create meaningful narratives and experiences. They must curate content that resonates with diverse audiences while upholding scholarly standards and ethical considerations. The main goal of any modern museum display is to evoke emotion in visitors. Digital content is most often presented through multimedia presentations that have an impact on most senses of the observer. In this way, the visitor is exposed to enhanced expression, creating a more intense impression.

AUDIENCE ENGAGEMENT - Curators are embracing digital platforms to engage audiences in new and interactive ways. They leverage social media, podcasts, webinars, and other digital channels to foster dialogue, encourage participation, and cultivate communities around cultural heritage. For the purposes of the exhibition, they create didactic and educational content for the audience in order to better understand and remember the theme and exhibited objects of the exhibition.

COLLABORATION AND PARTNERSHIPS

- Curators collaborate with digital experts, content creators, and other stakeholders to leverage expertise and resources in digital projects. Building partnerships with tech companies, universities, and cultural organizations enhances innovation and expands the reach of cultural initiatives. In the synergy of different professions working on the creation of digital cultural content, it is necessary, for better understanding, that experts use the same language based on digital terminology. Developing a dictionary of digital terms for museums could be the subject of a future project.

ETHICAL AND LEGAL CONSIDERATIONS

- Curators must navigate ethical and legal complexities in the digital realm, including copyright, intellectual property rights, and data privacy issues. They uphold ethical standards and ensure responsible stewardship of cultural heritage in the digital age.

Digitization presents a wealth of opportunities for curators to innovate, collaborate, and engage with audiences in transformative ways. By embracing digital technologies and adapting their roles to meet the challenges of the digital age, curators can enrich cultural experiences, preserve heritage for future generations, and foster greater understanding and appreciation of our shared humanity. As custodians of cultural heritage, curators play a vital role

in shaping the digital landscape and ensuring that cultural heritage remains accessible, relevant, and inspiring in an increasingly interconnected world. The changing role of curators in the digital age is characterized by a shift towards digital curation, audience engagement, collaboration, inclusivity,

ethical stewardship, and innovation. The Digital Curator Training program of the DCbox project is a crucial initiative in equipping curators with the skills and knowledge needed to navigate the digital landscape and create meaningful cultural experiences for audiences worldwide.

Large Language Models for Museums

Benefit or Threat?

Iva Vasic

Large Language Models (LLMs) gained popularity among users of a different background and a remarkable advancement has been seen with the release of OpenAI tools, in particular with the spread of ChatGPT. The ability of a human-like way to communicate with machines is a big step forward, making it powerful and daily used from basic conversation to complex task completion. In the field of museology, even though in the early stage, it could have a strong potential for a wide variety of tasks. For example, it has already demonstrated capabilities as a recommender system for in-person visits (Trichopoulos et al., 2023), an automated robot presenter combining knowledge graphs (Axelsson et al., 2023), or even understanding cultural properties in a museum (Mibayashi et al., 2022). The direction of LLM development is quite clear as it seems becoming “almighty”. As such, we should be also aware of the threats it may bring. Already, some identified arising risks have been highlighted by HLG-MOS in December 2023 including ethical issues,

copyright, and a general lack of awareness (HLG-MOS, 2023). Furthermore, users may encounter false or outdated information due to the limitations of up-to-date training data, and “hallucinations” which are entirely invented content. Another significant problem that has not been widely observed in the Cultural Heritage (CH) community is that it uses publicly available data for learning, ranging from expert knowledge to photographs taken by people. That is exactly how a current state-of-the-art DALL-E produces artistic paintings in less than a second using only one simple prompt, or Sora generates realistic videos using the identities of publicly available data. The question then arises – How will we even be able to recognize what is real and what is fake in the future? This essay discusses the benefits and potentials of LLM usage for virtual museums and artifacts. On the other hand, potential threats to the work of art identity are identified as a complement and an important ethical problem that should be considered.

BRIEF HISTORY OF ONLINE MUSEUMS AND DIGITAL ARTWORKS

The image of museums has undergone a profound transformation due to the digitalization of CH. In response to the COVID-19 pandemic, there was a notable surge in making their collections available online (Noehrer et al., 2021). This marked a clear pick in digitized content as museums responded to imminent challenges. Nevertheless, the first online museums appeared far before, amidst the invention of the World Wide Web. For example, a French student named Nicolas Pioche created a WebLouvre, which was later renamed WebMuseum for which the website was published in 1996 and it is still available online at [<https://www.ibiblio.org/wm//>]. He presented digital resources of notable quality at that period, which quickly gained popularity. Other early online museums include the University of California Museum of Paleontology at Berkeley in the US (UCMP Berkeley, 1997) and the EXPO online exhibition from the US Library of Congress (Library of Congress, n.d.) (Bowen, 2010). In the context of the online availability of information related to cultural artifacts, Google Arts & Culture and Europeana play a pivotal role nowadays. Hundreds of thousands of artworks are exhibited online and available for everybody interested in culture, both non-experts and CH professionals. Myriad virtual museums with exhibited

digital content have been published online including the Van Gogh Museum (Van Gogh Museum, n.d.), Museu Picasso (Museu Picasso, n.d.), and Civic Art Gallery of Ascoli (Vasic et al., 2024) among others. This trend is also highlighted by surveys and desk analysis by Nespeca et al (Nespeca et al., 2023).

ABOUT LARGE LANGUAGE MODELS

LLMs are the type of transformer models (Vaswani et al., 2017) in the branch of artificial intelligence (AI), trained on a vast amount of data. Their size is characterized by the number of parameters the model contains. The parameters serve as internal variables that the model learns, therefore larger models entail a greater quantity of parameters. Some powerful and trendy models, up to the moment of writing, are for instance GPT from OpenAI and Gemini from Google. In a broad overview, from the article of Vaswani et al., the architecture of the Transformer consists of encoder and decoder layers, each consisting of two sub-layers, a multi-head self-attention mechanism, and a position-wise fully connected feed-forward network. In addition to these two processes, the decoder performs also multi-head attention over the output produced by the encoder stack. One of the key novelties of Transformers is the self-attention mechanism (Tay et al., 2022). However, the power of LLMs

does not lie in its architecture only but also in the numerous parameters and countless sets of data used for its training.

LARGE LANGUAGE MODELS AS A SUPPORT FOR ARTWORK DESCRIPTION

LLMs became “smart” enough to produce realistic narratives but also to reason the semantics behind the artworks, which is important for the context of CH. It is easy for humans to connect the semantic meaning and to infer the reason for some event, hidden messages of a painter, or the reason for the missing hand of Venus de Milo. Machines on the other hand understand these by calculations of variables and it is quite impressive, but could it be comparable to the nuanced traditional historical analysis by experts? Anyway, all the knowledge neural networks can use comes from the laborious work of experts over the years. Traditionally, CH artifacts are described formally to hold a rigid structure of triple statements, creating a sort of semantic network, also referred to as a knowledge graph. This achievement is a mutual work of CH experts and more technical groups of people, yielding a valuable interdisciplinary product of great importance to humanity. However, modern LLMs learned not only semantics but also to decode knowledge graphs and infer a story from them. This could facilitate semantic artifact descriptions because one needs to know the ontological rules

for creating an accurate formal description and this prerequisite should not be neglected because artworks can be described by combining different ontologies. Being a complex task, LLMs can be used as a tool that helps experts to define artwork formal structures faster if learned or fine-tuned on a domain-specific ontology. However, observing the risks that AI may impose, we can also feel a threat of humans being completely replaced in this task. This concern arises from the potential of AI to quickly construct formal models based on freely available expert knowledge. Nevertheless, the accuracy of artificially produced knowledge is still questionable and should not be taken for granted.

LARGE LANGUAGE MODELS AND VISUAL CONTENT

In 2021, OpenAI’s DALL-E-generated art began to appear on the internet, taking the attention of many. With just a few words, the users could prompt the system to generate any picture from their thoughts. Like with all technologies, from just funny image creation and experimentation, it swiftly replaced lengthy designing manual tasks of non-professional individuals. Likewise, AI-generated artworks have emerged as a novel avenue for earning income. There is nothing wrong with new trends in art and AI-generated art as we are facing breakthroughs in development. Yet, concerns arise about what data

is utilized for such artificial art piece generation. The abundance of data exposed for free is part of many datasets and it is not a trivial task to identify if the part of one person in a random photograph is included in the AI-generated image. Consequently, the security of the art pieces from the digitized museums is potentially under threat as it is quite fast and simple to reproduce digital replicas from the digitized artworks and claim ownership.

CONCLUSION

On a brighter note, museum professionals and curators are provided with a great tool that can help create a personalized virtual tour due to its ability to process information from the image and infer semantics behind the artwork. It can serve as a conversational agent that analyses user requirements and guides visitors through the virtual or real museum, or even as an assistant to the experts in developing formal models for documenting artworks. Of course, an obstacle to this ideology remains in its underlying concept which is learning on enormous amounts of data and cannot

be restricted in any way. We cannot ask the AI system to “forget”. It can be fine-tuned in response, which still leaves doubts about the accuracy and integrity. We cannot control the sources in which the information is taken unless we train the model from scratch with selected data, which in the context of museums, is expert knowledge. This is, unfortunately, time-consuming or requires computing power which is rarely available to individuals and institutions. However, if combined with already defined formal expert knowledge such as already mentioned knowledge graphs, it can ensure a smarter and more reliable system. In this kind of combination, LLMs are efficient and creative, but also constrained and less prone to inferring false or ethically incorrect information. This study explained all aspects of LLMs, both opportunities and threats, keeping the balance between positive and negative opinions. The objective is to recognize how these powerful tools should be used and to identify problems that should be solved in this AI era, with a focus on current and future digital museums.

January 2042

An Interview into the Future with Sarah M., Digital Curator

Cristina Stefanelli in collaboration with ChatGPT

Nowadays, all museums and cultural sites offer digital opportunities that enhance the cultural experience of visitors. Developing digital strategies has become a key factor, and the DC-Box project has anticipated the skills needed for museum professionals, embracing the digital transformation of museums and anticipating the educational pathways for becoming a Digital Curator. In this article, we delve into the year 2042 to imagine the evolving role of a digital curator in a world shaped by advanced technologies and innovative curation practices.

Please note that the following conversation is purely fictional, envisioning the possibilities that could unfold in the realm of digital curation in the future. Enjoy this journey into the world of Sarah M., a digital curator navigating the frontiers of technology and culture.

Interviewer: Welcome to this special interview with Sarah M., Digital Curator at the Digital Heritage Institute. Sarah, can you start by telling us about your

role as a digital curator and how it has evolved in recent years?

Sarah: Certainly, thank you for having me. The role of a digital curator in 2042 has evolved significantly from traditional curatorial practices. In the digital realm, my responsibilities extend beyond managing physical artefacts to curating vast digital archives, virtual exhibits, and interactive experiences. I collaborate with experts in various fields, including technologists, data scientists, and artists, to create dynamic and engaging digital presentations.

Interviewer: How has technology influenced your work as a digital curator?

Sarah: Technology is at the heart of what I do. We leverage advanced technologies such as Artificial Intelligence (AI) for content analysis, recommendation algorithms for personalised experiences, and Augmented Reality (AR) and Virtual Reality (VR) for immersive exhibits. These technologies not only

enhance the visitor experience but also allow us to curate content in innovative ways, breaking traditional boundaries.

Interviewer: With the abundance of digital content, how do you navigate the challenges of information overload?

Sarah: Information overload is a constant challenge, but it's also an opportunity. We use sophisticated algorithms to analyse user behaviour, allowing us to understand preferences and tailor content recommendations. Additionally, my team and I play a crucial role in providing context and guiding visitors through the vast digital landscape, ensuring a curated and meaningful experience.

Interviewer: How do you address ethical considerations in your role as a digital curator?

Sarah: Ethical considerations are paramount. We are vigilant about issues related to privacy, representation, and cultural sensitivity. Our curation practices prioritise diversity and inclusivity, and we actively engage with communities to ensure their voices are heard and respected. It's crucial to strike a balance between technological advancements and ethical responsibilities.

Interviewer: Can you share an example of a recent project that highlights the opportunities digitization brings to curatorial work?

Sarah: One of our recent projects involved the use of Virtual Reality to recreate historical events, allowing users to immerse themselves in the past. This not only brought history to life but also provided an empathetic understanding of different perspectives. We combined archival material, oral histories, and cutting-edge VR technology to create a unique and educational experience.

Interviewer: Sarah, as we explore the advancements in your role as a Digital Curator, can you share a bit about your educational background? How did you prepare for a career in the digital curation landscape?

Sarah: In my educational journey, I pursued a multidisciplinary approach, combining studies in Digital Arts, Information Science, and Cultural Heritage Management. This fusion of disciplines allowed me to gain a comprehensive understanding of technology, information systems, and the preservation of cultural artefacts. Additionally, I engaged in specialised courses focusing on emerging technologies in the digital space, including virtual reality, artificial intelligence, and data analytics. This educational foundation equipped me with the skills to navigate the evolving landscape of digital curation and play a pivotal role in preserving and presenting our cultural heritage.

Interviewer: How do you see the role of a digital curator evolving in the future?

Sarah: The future holds exciting possibilities. I envision digital curators becoming even more interdisciplinary, collaborating with experts in emerging fields such as Extended Reality (XR), Quantum Computing, and Biotechnology. We'll likely see an increased emphasis on sustainability in digital curation, addressing the environmental impact of data storage and technological processes. Moreover, as technology continues to advance, our role will be about not just curating artefacts but curating experiences that resonate with a rapidly evolving society.

Interviewer: Thank you, Sarah, for sharing your insights with us. It's fascinating to see how technology is shaping

the way we preserve and present our cultural heritage.

Sarah: Thank you. It's been a pleasure discussing the exciting developments in the field of digital curation, and I'm optimistic about the future of preserving and sharing our collective history in the digital age.

Statement

During the preparation of this work the author used ChatGPT in order to simulate the interview. After using this tool, the author reviewed and edited the content as needed, and takes full responsibility for the content.



CHAPTER 7

Conclusion

Conclusion

Chapter 7

Ramona Quattrini

In concluding this book, it proves challenging to succinctly encapsulate all the findings and achievements. Primarily, it is noteworthy to delineate the forthcoming challenges within the context of professional skills development, that are also strictly related to further research lines development.

The increasing significance of the digital curator role in Europe arises from the imperative to address the challenges and seize the opportunities arising from the digital evolution of cultural heritage. This dynamic profession demands individuals capable of embracing technological progress, fostering interdisciplinary collaboration, and actively promoting the conservation and accessibility of a wide range of digital cultural assets.

The request for innovation cannot be disconnected from the context, as demonstrated by several innovative calls currently being implemented by national and international institutions. For example, the innovative procurement call “Smarter Italy,” funded by the PNRR (National Recovery and Resilience Plan) and managed by the National Agency for Digital (AGID), is currently being defined in Italy. For the cultural heritage challenge, it has envisaged a lengthy consultation phase involving beneficiaries, as demand drivers, expressing their needs. The program is based on the tool of “innovative procurement.” The public administration does not purchase standardised products or services already available on the market but encourages operators and companies to develop new solutions,



often based on emerging technologies, to concretely address the requirements expressed by local realities. This demonstrates that currently, the gaps are not so much technological but in skills and in choosing the digital maturity of a solution in relation to a context. In this sense, the need for new professional figures is becoming more urgent than ever.

It has been previously underscored, in this book, that no international or national legislation governing the profession of digital curator exists, nor are there directives outlining the practice thereof. To address this lack, DCbox has adhered to recommendations issued by international and European institutions, as well as recent trends and surveys coming from other initiatives and recognized working groups. These sources have provided invaluable guidance in formulating the structured training program. Nevertheless, notwithstanding the broader understanding that the profession of digital curation entails complexities extending beyond the mere management and preservation of digital data/information, DCbox has specifically focused its efforts on cultivating a professional trajectory within the cultural sector or Digital Cultural Heritage field. In doing so, DCbox seeks to empower practitioners to enrich curation practices with a novel array of competencies. Recognizing the pivotal role of digital curators in triggering digital transformation, DCbox contends that they serve as pivotal agents in imbuing museums and cultural institutions with a digital dimension and in disseminating their assets.

Moreover, as a culmination of this three-year project, the interdisciplinary nature of digital curation is confirmed and possibly further emphasised. This involves summarising key responsibilities delineated across various domains as defined within our framework.

Considering that several experts pointed out the systematic curation of exhibitions in both traditional and virtual formats, there is a highlighted need for enhancing competencies, also in apical positions. Additionally, professionals stress the

significance of cultivating skills tailored to the requirements of small museums, which often prioritise community engagement and operate distinctively from larger institutions. This underscores the importance of adapting managerial and strategic approaches according to the specific characteristics of smaller establishments and their ties to local communities—an aspect that will also be explored within the realm of communication.

The integration of technology is imperative to meet the evolving professional demands of museums and the broader cultural heritage sector. There is a pressing need to curate exhibitions in a hybrid manner, particularly by conceptualising virtual exhibitions alongside traditional in-person displays. This necessitates the development of phygital applications, i.e. applications merging the physical interaction and digital approaches, heralding a novel approach to engaging with heritage. In our learning approach this was applied by developing and supporting a proactive collaboration among teachers/researchers, learners and cultural institutions in the Virtual Living Labs, carrying out the prototypes. In this sense, the learning approach, as envisaged since the proposal, was not only theoretical but also and above all practical, including exercises already in the MOOC. A key part of the learning practice was the development of prototypes, which allowed teachers to experiment peer learning practices and students to test their skills by taking on a case study. Finally, or in some case during the prototype implementation, the learners had the chance to work in a real museum/cultural institution and assess their maturity in comparison with a specific context. These real experimentations and the testing of the approach, carried out during the traineeships, in 5 different educational curricula, are also able to warrant the exploitation of results, thanks to the strong interaction between academic and associated partners. This is reflected in the rubric assessment (see [Chapter 4.2 - Competencies, Learning Outcomes and KPI of the DCbox Learning Experience](#)), which encompasses both theoretical and practical competencies. DCbox defined

5 indicators, 2 referring to the MOOC, 2 referring to the prototyping phase of the learning experience and 1 is related to the traineeship. The learning outcomes identified are:

- a)** understanding of the digital transformation for Cultural Heritage and its application in the museum context;
- b)** Capacity of applying methods useful in the different digital cultural heritage domains;
- c)** Capacity of managing a curatorial project from the design to the development;
- d)** Capacity to set up a curatorial project according to the case study;
- e)** Capacity to localise the project to the real context and to adapt to the host institution of the traineeship.

Defining Key Performance Indicators (KPIs) for the learning experience in digital skills for heritage dissemination and communication is a valuable contribution to the sustainability of the project and the reusability of its results. Indeed, existing literature still lacks in the quantification of learning performance indicators, particularly within cross-disciplinary domains. Consequently, a key insight gleaned from the KPIs formulated within current taxonomies is the potential to establish a collaborative learning framework for Digital Cultural Heritage. This framework acknowledges that effective planning of experiences necessitates robust foundational knowledge and consideration of contextual factors.

A notable accomplishment of the DCbox project is the adoption of a micro-credential framework, facilitated through the open badge system and encapsulating precise and quantifiable competencies. The inclusion of flexible learning pathways, such as small learning experiences leading to micro-credentials is recommended for shaping the future of EU (Commission, 2022). In fact, the European approach to micro-credential

can help widen learning opportunities and strengthen the role of higher education and vocational education and training institutions in lifelong learning by providing more flexible and modular learning opportunities. This was also demonstrated in our case: indeed, not only students already enrolled in formal educational paths were interested in the DCbox course but also people already working in Cultural Heritage field and looking for up-skilling.

Constructing a cohesive pathway in the realm of digital cultural heritage presents also challenges, primarily due to the imperative of integrating diverse interdisciplinary contributions from various educators. The convergence of distinct disciplinary perspectives necessitates careful coordination and collaboration to ensure the efficacy and coherence of the educational trajectory. However, a notable risk exists: fragmented outcomes and ambiguities in delineating working opportunities can arise, stemming from the inherent complexity and multifaceted nature of the digital curation, which may impede the realisation of a unified and comprehensive educational approach.

In addition to these challenges, the project outlook underscores the significance of digital curators in facilitating participatory practices and advancing the sustainability mission of museums and cultural institutions. It is evident that sustainability lies at the heart of comprehending these professional imperatives and the broader thematic context. For instance, digital transformation can be embedded within a forward-looking strategy aimed at conserving resources for posterity, which entails engaging society and stakeholders, fostering a circular economy, and promoting environmental stewardship.

In conclusion, the DCbox project has highlighted the interdisciplinary nature of digital curation and emphasised the importance of addressing both theoretical and practical compe-

tencies in this field. By defining Key Performance Indicators for learning experiences and implementing a micro-credential framework, the project contributes to the sustainability and reusability of its results. However, challenges remain in constructing cohesive educational pathways due to the diverse interdisciplinary contributions involved. Despite these challenges, the project underscores the pivotal role of digital curators in advancing participatory practices and sustainability initiatives within museums and cultural institutions. Moving forward, it is clear that sustainability is integral to understanding and addressing the evolving professional imperatives in Digital Cultural Heritage, requiring collaborative efforts and innovative strategies to ensure the preservation and accessibility of cultural assets for future generations. May this journey through the DCbox project inspire continued exploration and innovation in the realm of digital curation, fostering a collective dedication to preserving our cultural heritage for generations to come.



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(All the quoted websites and online references were accessed between May 8, 2022 and April 30, 2024)

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Her lines of research focus on historical-critical and technical aspects of heritage preservation, in particular: restoration projects for historic architectures, preventive conservation and management plans for archaeological sites, heritage-led regeneration for historic urban landscape, as well as semantic representations and innovative technologies for accessing and managing cultural heritage.

She is the author of around 70 scientific publications on these topics, many of them presented during national and international congresses. She is a full member of the Italian Society for Architectural Restoration (SIRA). She is member of the "DISTORI Heritage", the interdisciplinary research lab in Digital Cultural Heritage for UNIVPM. She has been working on international scientific projects; she is currently involved in the European Erasmus + "DCbox project" which deals with teaching practices for digital curation of cultural heritage as communication manager.

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Isabel is a Master's degree student in Photography at Universidade Lusófona, Lisbon, Portugal. Her artistic works predominantly explore themes of vernacular archive, absence, and memory, often focusing on personal photographic archives, including both her own and those of others. These projects have resulted in several exhibitions, lectures, and limited-edition photobooks. Over the past decade, she has conducted investigative work, including living abroad, and actively engaging with local communities to deepen her understanding of other cultures. Having returned to Portugal in 2019, Isabel continues her exploration of memory, both personal and collective. She has participated in artistic residencies as both a participant and a producer. Additionally, Isabel is the Co-Founder and Creative Director of ANALOGICA - Analogue Photography Festival in Chamusca, Portugal, where she is dedicated to preserving analogue photography's timelessness while fostering innovation through traditional methods.

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Massimo Gasparini, graduated (Laurea Triennale) in "Scienze dei Beni Culturali" from the Università degli Studi di Urbino "Carlo Bo" (Univurb. Urbino, Italy) (2009), he completed his training with the completion of the Master (Laurea Magistrale) in "Archeologia e Letterature Classiche del Mediterraneo" (2011) studied at the Univurb.

He obtained the title of Doctor in "Architettura Classica e Studi Vitruviani. Analisi, rappresentazione, comunicazione, tutela" (2015) by the School of Engineering of the Università Politecnica delle Marche (Univpm, Ancona, Italy).

His postdoctoral training has been enriched thanks to obtaining a postdoctoral stay abroad (2015-2016) from the Univpm, developed in the Department of Art History, Archeology and Music of the University of

Córdoba (UCO) with the theme "Sviluppo di filiera produttiva speditiva e low-cost per l'acquisizione di documentazione grafica tridimensionale, basata su structure de motion, di complessi archeologici e architettonici".

He has participated, always with executive responsibility, in R+D+i projects at different levels, including international, among which he stands out as a member of the scientific team of the Missione Archeologica Italiana in Libya (Cyrene) of the Università degli Studi di Urbino "Carlo Bo" (Italy).

He also belongs to the PAI-HUM 882 Group Ancient Cities of Andalusia: from archaeological research to social profitability.

Additionally, Massimo has been director of several archaeological activities authorized by the Ministry of Culture and Historical Heritage of the Junta de Andalucía.

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Olesya Ivanova, an expert in Marketing and Communication, currently holds the position of Marketing Manager at Sinergia Consulenza S.r.l. in Pesaro, Italy, since 2021. Armed with a Master's Degree in Marketing and Communication from the University of Urbino Carlo Bo, her educational background is geared towards both the continuous updating of knowledge and the acquisition of operational skills for formulating and managing competitive and marketing strategies for companies.

In her role at Sinergia Consulenza, Ivanova manages marketing and communication activities, from identifying target groups and ensuring communication objectives are aligned with these groups, to drafting editorial plans that guide communication strategies. She is skilled in organizing and managing corporate events with team building objectives, enhancing the company's marketing and communication efforts in collaboration with Sinergia teams, and updating communication kits with branding elements such as websites, brochures, email signatures, and presentations.

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Olesya Ivanova has experience in the creation and technical management of Learning Management Systems (LMS), such as Moodle, for developing training courses.

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She published more than 100 works, including one book and 50 papers on scientific peer-reviewed journals. She has been selected in International Conferences as speaker and as participant, in addition she serves as Associate editor in the ACM Journal of Computing and Cultural Heritage.

She has been responsible in research projects based on competitive funding, dealing with digitization of cultural heritage and its exploitation for touristic purposes: IT-HR REMEMBER which implemented Virtual Museums regarding tangible and intangible heritage of 8 Adriatic ports, and Erasmus+ KA203 Rail to Land project, having in charge the 3D contents and narrative about landscape from the train. She served as scientific responsible of the Interreg AdriPromTour and of the Erasmus + project DCBox, which deals with teaching practices for digital curation of CH.

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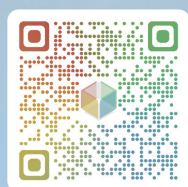
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