

# INSTRUCTIONAL DESIGN

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Supporting the Digital Transformation of Museums. The DCBox approach



# Supporting the Digital Transformation of Museums. The DCBox approach

Instructional design (D2.1 Methodology for the learning modules and LAB)

| General information             |   |
|---------------------------------|---|
| Due date of deliverable         | September 30,2022   |
| DELIVERABLE                     | <b>D2.1 Methodology for the learning modules and LAB</b><br><b>D2.2 Digital Curation Curriculum</b>   |
| Actual submission date          | March 21, 2023  |
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| Version                         | 4   |

# Summary

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# 1. Introduction to the course

The online course “Supporting the Digital Transformation of Museums. The DCBox approach”, produced within the DCBox project with the support of the Erasmus+ Programme of the European Union, 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 the digital transformation can enhance the offer of museums and supports current and future museum experts in exploiting successfully all the potential of digital technologies and tools.

The course targets primarily professional Digital curators and students of the courses of

- Digital Cultural Heritage (CYI)
- Building Engineering- Architecture (UNIVPM) with a specific curriculum in Heritage enhancement and management
- Tourism (UCO)
- Engineering and Architectural Representation and Drawing (Intercollegiate MD) (UCO)
- Management of Cultural and Natural Heritage in urban and rural environment (UCO)
- Architecture (LUSO)
- Educational Sciences & Arts (LUSO).
- Computers Animations, Computer Graphics, Multimedia and Computer Design (UNI),

The course is available in English. It will be piloted with a minimum of 20 learners from the partner universities.

In this document, we describe the main features of the course, highlighting the pedagogical approach adopted, the overall structure and content features of the course, the approach and tools for assessment and certification of learners.

## 2. The pedagogical approach to the course

*“After forty years of intensive research on school learning in the United States as well as abroad, my major conclusion is: What any person in the world can learn, almost all persons can learn if provided with **appropriate prior** and current conditions of learning.”*

Benjamin Bloom

DCBOX adopts the Bloom taxonomy<sup>1</sup> as a pedagogical framework for the definition of learning objectives and outcomes. The taxonomy, firstly published in 1956, places educational goals into specific categories to enable a better assessment of learners:



*Fig 1 the Bloom taxonomy*

In the pyramid, basic skills lie at the bottom, and more advanced ones reside at the top. As students progress, they make their way to the pinnacle.

Whilst initially developed to enable assessment, the 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, featured by 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 layer of the pyramid (representing a knowledge dimension) can be broken down into four degrees of knowledge: factual, conceptual, procedural and metacognitive.

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<sup>1</sup> Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals*. Vol. Handbook I: Cognitive domain. New York: David McKay Company

# Bloom's Taxonomy

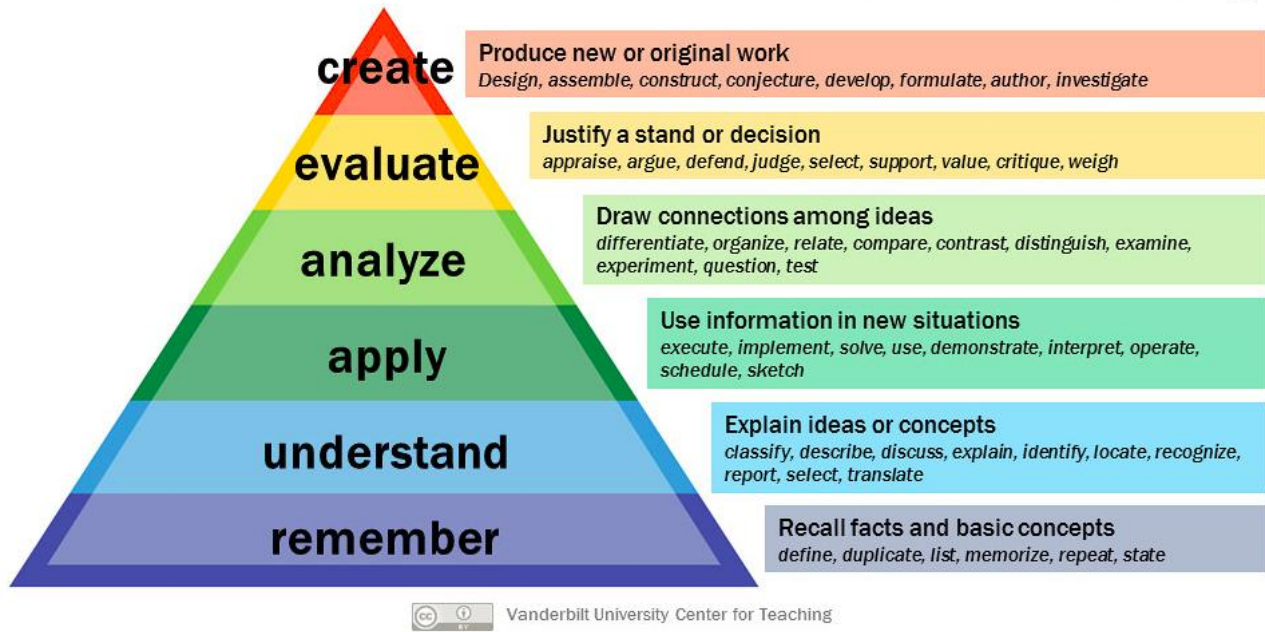


Fig 2 The Bloom taxonomy revised

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 aim for the course to create a significant learning experience for those involved.

In the following chapters, we will analyse the expected learning outcomes of the course and provide an overview about the course structure and content.

## 3. Target group and course participants' requirements

The course is addressed to professional museum staff and students of the faculties of Engineering, Architecture but also Humanities faculties, with the following characteristics:

- Basic ICT skills (use of computer, email, forum etc.)
- Curiosity and willingness to learn about heritage and museum digitization
- Openness to re-think and question one's working practice
- High engagement with individual and group learning activities
- Open to constructive feedback, respectful to others

The consortium has agreed to keep these requirements implicit and to avoid adopting entry requirements to the course, leaving it open to anyone interested.

## 4. Competences addressed by the course

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

- Ability to describe what digitization of Cultural Heritage is
- Ability to determine the main digital curator's skills
- Ability to define some technological innovation for museums
- Familiarity with 3D modeling related projects exploiting active (3D scanners) and passive sensors (DSLR cameras)
- Planning and data collection skills according to the most appropriate methodology
- Ability to process data and deliver accurate results
- Mastering of different methods for reality and non-reality-based 3D modelling
- Capacity to optimize 3D data for different kind of purposes
- Ability to Assess and evaluate Cultural Heritage Projects
- Ability to manage Digital Cultural Heritage being aware of international and European guidelines and rules
- Ability to guarantee the interchanging and preservation of Digital Cultural Heritage using the Open Formats
- Ability to manage and adapt Digital Cultural Heritage to the EN and ISO standards
- Capacity to develop good strategies for the cataloguing and information management of Digital Cultural Heritage
- Capacity to model data using the Entity-Relationship (ER) and the Enhanced Entity Relationship (EER) Models
- Being aware of the importance of Organization and Management in developing and running innovative information systems
- Being knowledgeable of the framework of digital dissemination for the Cultural Heritage Ability to use marketing principles and strategies
- Ability to preliminary design a museum website
- Being aware of the main Extended Reality technologies for Cultural Heritage
- Capacity to define and evaluate the best XR solution basing on some real cases
- Ability to ideate and develop simple applications for museums
- Being aware of the main AI technologies for Cultural Heritage
- Capacity to draft the most common assessment questionnaires
- Capacity to conduct a simple survey on a museum application

## 5. Course approach and phases

The course is delivered fully online, in English, on Moodle. It is fully open to any interested participant. There will be a differentiation in terms of certification as the learners selected by the project partners for the course piloting will receive an assessment certificate, stating the competences and knowledge achieved and the number of hours spent on the course (to enable institutional recognition in terms of ECTS where possible) whereas learners which are not part of the piloting will be able to access the modules but will not be granted tutoring services nor will they be able to run the quizzes during the piloting, and they will receive a certificate of participation.

The course is divided in 4 areas, each containing one or more modules, as follows:

|  |   |
|--|---|
| <b>Area A - DIGITAL TRANSFORMATION OF CULTURAL HERITAGE</b>              | <b>Module 1 – Digital transformation in Cultural Heritage</b>   |
| <b>Area B - ADVANCED 3D DIGITIZATION</b>                                 | <b>Module 2 - Digitization</b><br><b>Module 3 – 3D Modelling and data implementation</b>  |
| <b>Area C - POLICIES AND DIGITAL DATA PRESERVATION</b>                   | <b>Module 4 – Policy rules and licensing</b><br><b>Module 5 – Digital data preservation</b>   |
| <b>Area D - DIGITAL ACCESS: UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES</b> | <b>Module 6 - Communication and marketing strategies in Cultural Heritage</b><br><b>Module 7 - Virtualization</b><br><b>Module 8 – New frontiers in Cultural Heritage</b> |

Participants will be requested to complete all modules to get their certificate. Participants in the pilot will in addition be requested to run all the activities and quizzes to get their certificate.

The modules include videos with content authored by the consortium on the subjects addressed; link to complementary material (articles, web sites, publications, MOOCs, OER etc), activities (where relevant) to be implemented by the learner to test their skills acquisition; slides of the presentations given in the videos and quizzes to allow learners' self-assessment on the knowledge gained. A detailed structure of the modules is provided in Annex 1.

Based on the set of competences presented in chapter 4, the table below provides an overview of the Learning objectives and expected learning outcomes for each module/area.



| AREA   | Module   | Competences   | Learning Objectives   | Learning Outcomes   |
|--------|----------|---|---|---|
| AREA A | Module 1 | <ol style="list-style-type: none"> <li>1. To be able to describe what digitization of Cultural Heritage is</li> <li>2. To be able to determine the main digital curator's skills</li> <li>3. To be able to define some technological innovation for museums</li> </ol>  | <ul style="list-style-type: none"> <li>• To become aware of the importance of preserving and enhancing Digital Cultural Heritage</li> <li>• To explain terms like museology, museography, digital humanities, digital twin, digital heritage</li> <li>• To become aware of the role of the museum curator throughout the years</li> <li>• To define the requested humanistic and digital skills to participate in the digitization process</li> </ul>   | <p>At the end of the first module students will own some basic concepts and principles as regards Digital Cultural Heritage and all the involved processes. Students will become aware of some essential keywords like digitization, digitalization, museology, digital humanities, digital twin and will be exposed to a brief overview of the curator's figure since the 15<sup>th</sup> century to the modern digital age. The essential humanistic and digital skills for a digital curator will be discussed to preserve, enhance and disseminate Cultural Heritage.</p> |
| AREA B | Module 2 | <ol style="list-style-type: none"> <li>1. To be able to complete 3D modeling related projects exploiting active (3D scanners) and passive sensors (DSLR cameras)</li> <li>2. To be able to plan and collect data according to the most appropriate methodology</li> <li>3. To be able to process data and deliver accurate results</li> </ol> | <ul style="list-style-type: none"> <li>• To understand the main difference between active and passive sensors</li> <li>• To be able to choose the most appropriate technique according to the specific project goal</li> <li>• To understand the full range-based 3D modelling pipeline for data processing: from range maps to a complete 3D model</li> <li>• To understand the full image-based 3D modelling pipeline: from images to a complete 3D model</li> <li>• To understand the potentialities of high-resolution imaging techniques</li> <li>• To be able to process 3D data exploiting a wide array of software</li> <li>• To understand how to assess the conservation conditions exploiting range-based techniques and perform basic analysis of objects of different scales.</li> </ul> | <p>By the end of the Module the students will develop the competences that allow them to plan, perform, process the collected data, and deliver a high-resolution accurate 3D model or 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.</p>  |

|               |                 |  |   |   |
|---------------|-----------------|--|---|---|
| <b>AREA B</b> | <b>Module 3</b> | <p>To be able to complete master different methods for reality and non-reality-based 3D modelling</p> <p>To be able to post process and optimize 3D data for different kind of purposes</p> <p>To Assess and evaluate Cultural Heritage Projects</p>   | <p>To understand and practice on 3D modelling and data optimization</p> <p>To study and assess direct and procedural modelling through the analysis of real case studies</p> <p>To perform and complete virtual restoration and 3D modelling restoration tasks through practical exercises</p>  | <p>By the end of the Module the students will have a broad understanding of the technique to process, optimize and manage reality and non-reality-based 3D models. They will be introduced to the use of several post-processing software and 3D data ranging from small objects to monumental scale. Students will have the chance to analyze and discuss on real case-studies, developing an analytical and critical thinking process.</p>                    |
| <b>AREA C</b> | <b>Module 4</b> | <p>To be able to manage Digital Cultural Heritage according to international and European guidelines and rules</p> <p>To be able to guarantee the interchanging and preservation of Digital Cultural Heritage using the Open Formats</p> <p>To be able to manage and adapt Digital Cultural Heritage to the EN and ISO standards</p> | <p>To learn about the International Conventions and the European and national laws related to Digital Cultural Heritage</p> <p>To be able to define what Digital Cultural Heritage is.</p> <p>To be introduced to intellectual property laws in connection to cultural institutions and Digital Cultural Heritage</p> <p>To understand the EN and ISO standards regarding the management of digital sources and adapt them to Digital Cultural Heritage</p> <p>To learn about the Open Data Formats that can be used for Digital Cultural Heritage</p> <p>To be able to promote standardized interoperability and interchanging of Digital Cultural Heritage between institutions</p> | <p>By the end of the module the students will develop the competences 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 standardizing Digital Cultural Heritage for the international scenario. In addition, they will be able to use the Open formats for digital cultural heritage's preservation.</p> |

|               |                 |  |  |   |
|---------------|-----------------|--|--|---|
| <b>AREA C</b> | <b>Module 5</b> | <p>To be able to develop good strategies for the cataloguing and information management of Digital Cultural Heritage</p> <p>To be able to model data using the Entity-Relationship (ER) and the Enhanced Entity Relationship (EER) Models</p> <p>To be able to understand the importance of Organization and Management in developing and running innovative information systems</p> | <p>To learn the methodologies of cataloguing Cultural Heritage</p> <p>To be able to define the main areas of interest aimed at communicating and enhancing the cultural heritage</p> <p>To understand Database System Concepts and Architecture</p> <p>To create database queries</p> <p>To learn basic concept of Structured Query Language (SQL).</p> <p>To be able to create strategic and long-term planning information management system</p> | <p>By the end of the module the students will be able to develop state-of-the-art strategies regarding the preservation and interchanging of the digital data and they will acquire the knowledge that allow them to develop long- and short-term plans for the information management and cataloguing of Cultural Heritage.</p> <p>In addition, the students will be able to understand data model, to interact with existing databases and to collaborate with software engineers to design data-centric applications focused on Digital Cultural Heritage.</p> |
| <b>AREA D</b> | <b>Module 6</b> | <p>To be able to understand the framework of digital dissemination for the Cultural Heritage</p> <p>To be able to use marketing principles and strategies</p> <p>To be able to preliminary design a museum website</p>   | <p>To understand the framework of digital dissemination for the Cultural Heritage</p> <p>To acquire some marketing principles and strategies</p> <p>To preliminary design a museum website</p>   | <p>By the end of the course students will develop the competences 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, podcasting, students will be able to ideate a hypothetical museum website.</p>   |

|                      |                        |   |   |  |
|----------------------|------------------------|---|---|--|
| <p><b>AREA D</b></p> | <p><b>Module 7</b></p> | <p>To be able to distinguish the main Extended Reality technologies for Cultural Heritage<br/>         To be able to define and evaluate the best XR solution basing on some real cases<br/>         To be able to ideate and develop simple applications for museums</p> | <p>To learn the main concepts, enabling technologies, and key applications for XR in CH<br/>         To recognize strengths and weaknesses of VR and AR for new XR applications<br/>         To become aware of the main applications for web, mobile and wearable devices<br/>         To develop a simple XR application</p>                      | <p>By the end of the module, students will be able to explain the 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 CH. In the activity students will choose the most effective technology based on some real case scenario.<br/>         In addition, students will be able to recognize and classify all the applications according to the technology and the device and will gain good knowledge of some common software. Furthermore, students will test an available platform for the development of new XR experiences for a museum collection.</p> |
| <p><b>AREA D</b></p> | <p><b>Module 8</b></p> | <p>To be able to distinguish the main AI technologies for Cultural Heritage<br/>         To be able to define most common assessment questionnaires<br/>         To be able to conduct a simple survey on a museum application</p>  | <p>To explain terms like Machine Learning, Deep Learning and Neural Networks<br/>         -To become aware of best practices of AI in the heritage science<br/>         -To become aware of the most common assessment questionnaires and their underlying concepts<br/>         -To design and conduct a simple survey on a museum application</p> | <p>By the end of this module, students will learn what Artificial Intelligence (AI) is, explore concrete cases and applications of AI, 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 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 engagements and level of readiness. Finally, they will carry out an activity designing and producing a simple assessment questionnaire about a museum application.</p>             |

## 7. Course content

The course is composed of four areas, which explore 4 key aspects of the digital transformation of museums. Each area contains one or more modules, as follows:

### AREA A – DIGITAL TRANSFORMATION OF MUSEUMS

#### Module 1. Digital transformation of museums

Module 1 is an introduction to the course's contents and objectives. The digital transformation is the most effective process in order to preserve, enhance and disseminate the CH. Since in the next modules you will face the most common used tools and techniques, a proper overview on the fascinating scenario of Digital Cultural heritage can give you a sound base.

### AREA B – ADVANCED 3D DIGITIZATION

#### Module 2. Digitization

**Module 2** tackles the reality-based 3D modelling domain from different perspectives, in order to provide a solid knowledge of all the methodologies involved. Lectures will be mixed together with practical exercises and tutorials.

#### Module 3. 3D Modelling and data implementation

Module 3 tackles the 3D modelling workflow for reality and non-reality-based data post processing and data optimization. Both practical and theoretical approaches will be highlighted, coupled with real case studies.

### AREA C – POLICY AND DIGITAL DATA PRESERVATION

#### Module 4 – Policy rules and licensing

Module 4 provides a number of essential topics for management and preservation of Digital Cultural Heritage. It includes the study of European policies and recommendations for Digital Cultural Heritage; Digital information and Cultural Heritage Law; EN and ISO standards and Open File Formats for interchanging and preservation.

#### Module 5 – Digital data preservation

Module 5 provides a number of essential topics for management and preservation of Digital Cultural Heritage. It includes the Digital Cataloguing strategies for Cultural Heritage; Tools and techniques for cataloguing; Database design and Information Management System.

## AREA D – DIGITAL ACCESS: UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES

### Module 6. Communication and marketing strategies in Cultural Heritage

The dissemination and the communication of the digital Cultural Heritage owned by museum represents of the main Topic and challenge. This module focuses on Tools, resources, best practices, and descriptive standards for building robust digital collection programs and for adopting marketing strategies.

### Module 7. Virtualisation

Cultural Heritage virtualisation represents a challenge in terms of humanities and informatics skills. It is a tangible means for the enhancement and the narrative of museums' collections. Module 7 offers a concise and effective overview of the Extended Reality technologies and explains how they are employed in the sector of the app developing through the study of some of the best digital practice.

### Module 8. New frontiers in Cultural heritage

Some of the new frontiers in CH will be discussed in this module. By using AI and XR technologies it is possible to implement sophisticated tracking of user experiences or automatized the 3d modelling processes that currently are mostly manual.

## 8. Learners' assessment

Assessment will be both formative and summative:

- **Formative:** Tutors will assess the acquired knowledge and skills of tutors by checking the learners' activities during the Modules and providing feedback to learners. At least one tutor per partner will be identified, and tutorship will be vertical (learners will have to relate to different tutors depending on the module and specific subject addressed).
- **Summative:** Quizzes are provided in each module to let learners self-assess their acquired knowledge

In each module, we have indicated the skills and knowledge that learners are expected to gain. Assessment in quizzes and by tutors will be therefore based on the defined competence and knowledge framework.

## 9. Course certification

Upon completion of the course based on the assessment criteria described above, learners being part of the pilot will receive a Competence **Certificate**, in PDF by the project with title of the training, partners' logos, n. of hours, curriculum, etc. Each HE partners' institution will define internally the feasibility of including in the certificate the number of acknowledged ECTS to the students. Learners who took the course not being part of the pilot will receive a Certificate of Attendance.

# **ANNEX 1.**

## **Module template**

## DCBOX Module Template

|  |   |
|--|---|
| <b>Basic data of the module</b>            |   |
| <b>Area title</b>                          |   |
| <b>Module title and number</b>             |   |
| <b>Lessons Included</b>                    |   |
| <b>Authors</b>                             |   |
| <b>Duration of the module (in hrs)</b>     |   |
| <b>Introduction and module description</b> | This module is about.... It is aimed to ..... |

**1. Specific Competences addressed in the module**

**2. Learning objectives of the module**

**3. Expected Learning outcomes**

4. Video

**Video in English provided by the involved partners.**

**5. Text**

Written information about theories and practices.

**6. Activities**

**7. Quiz/ Self-assessment test**

**8. Bibliography**

**9. Relevant Material**



## **ANNEX 2. Digital Curation Curriculum (D2.2)**

# AREA A



## DIGITAL TRASFORMATION OF CULTURAL HERITAGE



|                 |  |
|-----------------|--|
| <b>AREA A</b>   | <b>Digital transformation of Cultural Heritage</b> |
| <b>MODULE 1</b> | <b>Digital transformation of Cultural Heritage</b> |
| Lesson 1.1      | Digitization and digitalization                    |
| Lesson 1.2      | Digital Museology and Museography                  |
| Lesson 1.3      | Digital Humanities                                 |
| Lesson 1.4      | Digital curator's role                             |
| Lesson 1.5      | Storytelling for CH                                |
| <b>Quiz 1</b>   |  |

# MODULE 1. DIGITAL TRANSFORMATION OF CH

|  |  |
|--|--|
| <b>Responsible</b>                         | Università Politecnica delle Marche (UNIVPM)   |
| <b>Contents</b>                            | 5 lessons + 1 quiz   |
| <b>Introduction and module description</b> | The module 1 is an introduction to the course's contents and objectives. The digital transformation is the most effective process in order to preserve, enhance and disseminate the CH. Since in the next modules you will face the most common used tools and techniques, a proper overview on the fascinating scenario of Digital Cultural heritage can give you a sound base. |

## Specific Competences addressed in the module

1. To be able to describe what digitization of Cultural Heritage is
2. To be able to determine the main digital curator's skills
3. To be able to define some technological innovation for museums

## Learning objectives of the module

- To become aware of the importance of preserving and enhancing Digital Cultural Heritage
- To explain terms like museology, museography, digital humanities, digital twin, digital heritage
- To become aware of the role of the museum curator throughout the years
- To define the requested humanistic and digital skills to participate in the digitization process

## Expected Learning outcomes

At the end of the first module students will own some basic concepts and principles as regards Digital Cultural Heritage and all the involved processes. It will allow students to have a sound base to better focus on the main topics and activities addressed in the next modules. Students will become aware of some essential keywords like digitization, digitalization, museology, digital humanities, digital twin and will be exposed to a brief overview of the curator's figure since the 15<sup>th</sup> century to the modern digital age. The essential humanistic and digital skills for a digital curator will be discussed in order to preserve, enhance and disseminate Cultural Heritage.

## Video

[1.1.mp4](#)

Lesson 1.2

Lesson 1.3

Lesson 1.4

Lesson 1.5

## Text

[Lesson 1.1](#)

[Lesson 1.2](#)

[Lesson 1.3](#)

[Lesson 1.4](#)

[Lesson 1.5](#)

## Activities

There is no planned activity for Module 1

## Quiz/Self-assessment test

Quiz Module 1

## Bibliography

### Lesson 1.1

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## Lesson 1.5

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[DigCurV - Skills in Digital Curation Curriculum Framework \(gla.ac.uk\)](https://www.gla.ac.uk/digcurv/)

# AREA B



## ADVANCED 3D DIGITIZATION





|                          |                                   |
|--------------------------|-----------------------------------|
| <b>AREA B</b>            | <b>Advanced 3D Digitization</b>   |
| <b>MODULE 2</b>          | <b>Digitization</b>               |
| Lesson 2.1               | Range-based digitization          |
| Lesson 2.2               | Range-based survey techniques     |
| Lesson 2.3               | Image-based digitization          |
| Lesson 2.4               | Image-based survey techniques     |
| Lesson 2.5               | Structure from motion             |
| Lesson 2.6               | High resolution images production |
| Lesson 2.7               | Projects overview: HD paintings   |
| <b>Quiz<br/>Module 2</b> |                                   |

## MODULE 2. DIGITIZATION

|  |  |
|--|--|
| <b>Responsible</b>                         | The Cyprus Institute (Cyl)   |
| <b>Contents</b>                            | 7 lessons + 1 quiz   |
| <b>Introduction and module description</b> | The Module 2 tackles the reality-based 3D modelling domain from different perspectives, in order to provide a solid knowledge of all the methodologies involved. Lectures will be mixed together with practical exercises and tutorials. |

### Specific Competences addressed in the module

1. To be able to complete 3D modeling related projects exploiting active (3D scanners) and passive sensors (DSLR cameras)
2. To be able to plan and collect data according to the most appropriate methodology
3. To be able to process data and deliver accurate results

### Learning objectives of the module

- To understand the main difference between active and passive sensors
- To be able to choose 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 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.

### Expected Learning outcomes

By the end of the Module the students will develop the competences that allow them to plan, perform, process the collected data, and deliver a high-resolution accurate 3D model or 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.

### Video

Lesson 2.1

Lesson 2.2

Lesson 2.3

Lesson 2.4

Lesson 2.5

Lesson 2.6

Lesson 2.7

## Text

Lesson 2.1

Lesson 2.2

Lesson 2.3

Lesson 2.4

Lesson 2.5

Lesson 2.6

Lesson 2.7

## Activities

### Activity 2.3

#### 2.3 Point clouds alignment

|                    |  |
|--------------------|--|
| <b>Tutor</b>       | Daniele Arturo De Luca   |
| <b>Description</b> | In this activity the students will be guided through the workflow for point cloud alignment. A step-by-step booklet will be provided highlighting all the tasks. |
| <b>Explanation</b> | Upload a screenshot of the clouds aligned with the report as shown in the tutorial   |

## Quiz/Self-assessment test

Quiz Module 2

## Bibliography

### Lesson 2.1

Blais, F., 2004. Review of 20 years of range sensor development. *Journal of electronic imaging*, 13(1), pp.231-243.

### Lesson 2.2

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Remondino, F., & El-Hakim, S. (2006). Image-based 3D modelling: a review. *The photogrammetric record*, 21(115), 269-291.

### Lesson 2.7

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### Lesson 2.8

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|                          |   |
|--------------------------|---|
| <b>AREA B</b>            | <b>Advanced 3D Digitization</b>             |
| <b>MODULE 3</b>          | <b>3D Modelling and Data Implementation</b> |
| Lesson 3.1               | 3d modelling and data optimization          |
| Lesson 3.2               | Projects overview: direct modelling         |
| Lesson 3.3               | Projects overview: reality-based modelling  |
| Lesson 3.4               | Virtual Reconstruction                      |
| <b>Quiz<br/>Module 3</b> |   |

## **MODULE 3. 3D MODELLING AND DATA IMPLEMENTATION**

|  |   |
|--|---|
| <b>Responsible</b>                         | The Cyprus Institute (Cyl)  |
| <b>Contents</b>                            | 4 lessons + 1 Activity + 1 quiz   |
| <b>Introduction and module description</b> | The Module 3 tackles the 3D modelling workflow for reality and non-reality-based data post processing and data optimization. Both practical and theoretical approaches will be highlighted, coupled with real case studies. |

## Specific Competences addressed in the module

1. To be able to complete master different methods for reality and non-reality-based 3D modelling
2. To be able to post process and optimize 3D data for different kind of purposes
3. To Assess and evaluate Cultural Heritage Projects

## Learning objectives of the module

- To understand and practice on 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

## Expected Learning outcomes

By the end of the Module the students will have a broad understanding of the technique to process, optimize and manage reality and non-reality-based 3D models.

They will be introduced to the use of several post-processing software and 3D data ranging from small objects to monumental scale. Students will have the chance to analyze and discuss on real case-studies, developing an analytical and critical thinking process.

## Video

Lesson 3.1

Lesson 3.2

Lesson 3.3

Lesson 3.4

## Text

Lesson 3.1

Lesson 3.2

Lesson 3.3

Lesson 3.4

## Activities

### Activity 3.5

#### 3.5 3D Model Reconstruction

|                    |  |
|--------------------|--|
| <b>Tutor</b>       |  |
| <b>Description</b> | In this activity the students will be guided through a specific 3D model reconstruction method in order to optimize and reconstruct missing parts on image- and range-based born models. Special attention has been dedicated to the hole-filling technique. |
| <b>Explanation</b> |  |

## Quiz/Self-assessment test

Quiz Module 3

## Bibliography

### Lesson 3.1

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### Lesson 3.2

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### Lesson 3.4

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## Relevant material

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The School of Athens video - <https://www.youtube.com/watch?v=dipnvn6Dy4c&t=23s>

Campana caves videos - <https://www.youtube.com/watch?v=uYg1749ISK0>;  
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# AREA C



## POLICIES AND DIGITAL DATA PRESERVATION



| <b>AREA C</b>   | <b>POLICIES AND DIGITAL DATA PRESERVATION</b>               |
|-----------------|---|
| <b>MODULE 4</b> | <b>Policies rules and licensing</b>                         |
| Lesson 4.1      | Excursus over the last decades                              |
| Lesson 4.2      | CH laws   |
| Lesson 4.3      | DCH Laws between public institutions and private businesses |
| Lesson 4.4      | ISO and EN standards  |
| Lesson 4.5      | Open File Formats: images, videos, sounds                   |
| Lesson 4.6      | Open File Formats: Point Clouds, Mesh                       |

## **MODULE 4. POLICIES RULES AND LICENSING**

|  |  |
|--|--|
| <b>Responsible</b>                         | University of Córdoba (UCO)  |
| <b>Contents</b>                            | 5 lessons + 1 quiz   |
| <b>Introduction and module description</b> | The module 4 provides a number of essential topics for management and preservation of Digital Cultural Heritage. It includes the study of European policies and recommendations for Digital Cultural Heritage; Digital information and Cultural Heritage Law; EN and ISO standards and Open File Formats for interchanging and preservation. |

## Specific Competences addressed in the module

- To be able to manage Digital Cultural Heritage according to international and European guidelines and rules
- To be able to guarantee the interchanging and preservation of Digital Cultural Heritage using the Open Formats
- To be able to manage and adapt Digital Cultural Heritage to the EN and ISO standards

## Learning objectives of the module

- 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

## Expected Learning outcomes

By the end of the module the students will develop the competences 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 standardizing Digital Cultural Heritage for the international scenario. In addition, they will be able to use the Open formats for digital cultural heritage's preservation.

## Video

Lesson 4.1.

Lesson 4.2.

Lesson 4.3.

Lesson 4.4.

Lesson 4.5.

Lesson 4.6.

## Text

Lesson 4.1

### [4.1. Excursus over the last decades](#)

Lesson 4.2

### [4.2. CH laws](#)

Lesson 4.3

### [4.3. DCH Laws between Public institutions and private businesses](#)

Lesson 4.4

### [4.4. ISO and EN standards](#)

## Lesson 4.5

### 4.5. Open File Formats: images, videos, sounds, point clouds and meshes

## Quiz/Self-assessment test

### Quiz 4

## Bibliography

### Lesson 4.1

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<https://digital-strategy.ec.europa.eu/en/library/declaration-european-digital-rights-and-principles> -

[https://ec.europa.eu/isa2/isa2\\_en/](https://ec.europa.eu/isa2/isa2_en/) - ISA2 – Interoperability solutions for public administrations, business and citizens

<https://en.unesco.org/themes/building-knowledge-societies/wsis#:~:text=The%20Geneva%20Plan%20of%20Action,potential%20of%20ICTs%20for%20development.>

[https://www.itu.int/dms\\_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0004!!PDF-E.pdf](https://www.itu.int/dms_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0004!!PDF-E.pdf) - Declaration of principles – World Summit on the Information Society 2003

### Lesson 4.2

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[2] <https://whc.unesco.org/en/conventiontext/> - Convention Concerning the Protection of the World Cultural and Natural Heritage

[3] <https://www.coe.int/en/web/herein-system/european-union> - European Heritage network - most relevant documents

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

<https://unesdoc.unesco.org/ark:/48223/pf0000368300> - UNESCO on cultural property protection

### Lesson 4.3

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### Lesson 4.4

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#### Lesson 4.5

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## Relevant Material

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| <b>AREA C</b>   | <b>POLICIES AND DIGITAL DATA PRESERVATION</b> |
|-----------------|---|
| <b>Module 5</b> | <b>Digital data preservation</b>              |
| Lesson 5.1      | Digital cataloguing strategies for CH         |
| Lesson 5.2      | Digital cataloguing tools and techniques      |
| Lesson 5.3      | Database design                               |
| Lesson 5.4      | Data models (ER, EER)                         |
| Lesson 5.5      | Database development                          |
| Lesson 5.6      | Information management methodologies          |
| Lesson 5.7      | Planning tools                                |

| <b>MODULE 5. DIGITAL DATA PRESERVATION</b> |   |
|--|---|
| <b>Responsible</b>                         | University of Córdoba (UCO)   |
| <b>Contents</b>                            | 5 Lessons + 1 Activity + 1 Quiz   |
| <b>Introduction and module description</b> | The module 5 provides a number of essential topics for management and preservation of Digital Cultural Heritage. It includes the Digital Cataloguing strategies for Cultural Heritage; Tools and techniques for cataloguing; Database design and Information Management System. |

## Specific Competences addressed in the module

- To be able to develop good strategies for the cataloguing and information management of Digital Cultural Heritage
- To be able to model data using the Entity-Relationship (ER) and the Enhanced Entity Relationship (EER) Models
- To be able to understand the importance of Organization and Management in developing and running innovative information systems

## Learning objectives of the module

- To learn the methodologies of 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 basic concept of Structured Query Language (SQL).
- To be able to create strategic and long-term planning information management system

## Expected Learning outcomes

By the end of the module the students will be able to develop state-of-the-art strategies regarding the preservation and interchanging of the digital data and they will acquire the knowledge that allow 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 model, to interact with existing databases and to collaborate with software engineers to design data-centric applications focused on Digital Cultural Heritage.

## Video

Lesson 5.1

Lesson 5.2

Lesson 5.3

Lesson 5.4

Lesson 5.5

Lesson 5.6

Lesson 5.7

## Text

Lesson 5.1

[5.1. Digital Cataloguing strategies for CH](#)

Lesson 5.3

[5.3. Database design](#)

Lesson 5.4



## [5.4. Data models \(ER, EER\)](#)

Lesson 5.5

## [5.5. Database development](#)

Lesson 5.6

## [5.6. Information management methodologies](#)

Lesson 5.7

## [5.7. Planning tools](#)

### Activities

Activity 5.2

#### 5.2 Digital cataloging tools and techniques

|                    |  |
|--------------------|--|
| <b>Tutor</b>       | Andrea de Aceijas  |
| <b>Description</b> | In this activity you will be able to do a Catalog file following the steps you have learn in the lesson.   |
| <b>Explanation</b> | Following the previous lesson, you will be able to do a catalog file with the examples mentioned. You will select a heritage asset from your town or community that is not listed in Europeana and we will create its catalog file following the structure studied. Once the file is completed, it must be accompanied by a brief report explaining points detailed in the activity. |

### Quiz/Self-assessment test

Quiz 5

### Bibliography

#### 5.1

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[1] Michael J. Hernandez, *Database Design for Mere Mortals: A Hands-on Guide to Relational Database Design*, Addison-Wesley, 2013, ISBN: 0321884493, 9780321884497

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[1] Gruber, T. (2001). "What is an Ontology?". Stanford University. Archived from the original on 2010-07-16. Retrieved 2009-11-09.

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## 5.6

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[2] Consultative Committee for Space Data Systems, 2012. Reference model for an open archival information system (OAIS): Recommended practice (CCSDS 650.0-M-2: Magenta Book), CCSDS, Washington, DC. Available: <https://public.ccsds.org/pubs/650x0m2.pdf>

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## Relevant

## Material

[Preservación digital y catalogación | Buenos Aires Ciudad - Gobierno de la Ciudad Autónoma de Buenos Aires](#)

[\(PDF\) Heritage Cataloguing in History: Conceptual and Graphical Foundations of Immoveable Cultural Heritage Data Bases in the Case of Spain | Roberto F Alonso-Jiménez - Academia.edu](#)

[Formato UNIMARC | Biblioteca Nacional de España \(bne.es\)](#)

[Digital Cultural Heritage Projects: Opportunities and Future Challenges - ScienceDirect](#)

[Enlaces de CER.es Colecciones en Red - | Ministerio de Cultura y Deporte](#)

[: UNESCO Thesaurus](#)

[British Museum Materials Thesaurus \(collectionstrust.org.uk\)](#)

[British Museum Object Names Thesaurus \(collectionstrust.org.uk\)](#)

[P:\\\_Projet HEREIN\ Website new structure\5. Terminology\Test\thesaurusEFGS \(coe.int\)](#)

[MDA Archaeological Objects Thesaurus \(vocabularyserver.com\)](#)

# AREA D



## DIGITAL ACCESS: UNIVERSAL DESIGN AND VIRTUAL EXPERIENCES



|                     |   |
|---------------------|---|
| <b>AREA D</b>       | <b>Digital access: Universal design and virtual experiences</b> |
| <b>MODULE 6</b>     | <b>Communication</b>  |
| Lesson 6.1          | Managing of websites  |
| Lesson 6.2          | Virtual exhibitions   |
| Lesson 6.3          | Video production and podcasting for museums                     |
| Lesson 6.4          | Digital accessibility and inclusion                             |
| <b>Activity 6.5</b> | Making of a Website   |
| <b>Quiz 6</b>       |   |

## MODULE 6. COMMUNICATION

|  |  |
|--|--|
| <b>Responsible</b>                         | Universidade Lusófona (LUSO)   |
| <b>Contents</b>                            | 4 Lessons + 1 Activity + 1 Quiz  |
| <b>Introduction and module description</b> | The dissemination and the communication of the digital Cultural Heritage owned by museum represents of the main Topic and challenge. This module focuses on Tools, resources, best practices, and descriptive standards for building robust digital collection programs and for adopting marketing strategies. |

## Specific Competences addressed in the module

1. To be able to understand the framework of digital dissemination for the Cultural Heritage
2. To be able to use marketing principles and strategies
3. To be able to preliminary design a museum website

## Learning objectives of the module

- To understand the framework of digital dissemination for the Cultural Heritage
- To acquire some marketing principles and strategies
- To preliminary design a museum website

## Expected Learning outcomes

By the end of the course students will develop the competences that allow them to orient themselves in the world of digital tools, especially with regard to the relationship between cultural heritage and the public. With the presentation of tools like website, video production, podcasting, students will be able to ideate a hypothetical museum website.

## Video

Lesson 6.1

Lesson 6.2

Lesson 6.3

Lesson 6.4

## Text

[Lesson 6.1](#)

[Lesson 6.2](#)

[Lesson 6.3](#)

[Lesson 6.4](#)

## Activities

### 6.5 Making of a Website

|                    |  |
|--------------------|--|
| <b>Tutor</b>       | Ricardo Geraldes   |
| <b>Description</b> | In this activity the students 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.   |
| <b>Explanation</b> | 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. |

## Quiz/Self-assessment test

Quiz 6

## Bibliography

### Lesson 6.1

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## Relevant material

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<https://artsandculture.google.com/story/gAWhceMYFOAfIA>

Museu Nacional dos Coches / National Coach Museum, Lisbon <https://my.matterport.com/show/?m=crADZwGeEXF>

British Museum, London

<https://britishmuseum.withgoogle.com/>

Uffizi Gallery, Florence

<https://www.uffizi.it/en>

Guggenheim Museum, New York

<https://artsandculture.google.com/partner/solomon-r-guggenheim-museum>

<https://www.youtube.com/watch?v=9n9KacDbpzw>

<https://www.w3.org/>



|                     |   |
|---------------------|---|
| <b>AREA D</b>       | <b>Digital access: Universal design and virtual experiences</b> |
| <b>MODULE 7</b>     | <b>Virtualization</b>   |
| Lesson 7.1          | Virtual Reality   |
| Lesson 7.2          | Augmented & Mixed Reality                                       |
| Lesson 7.3          | Applications on the web   |
| Lesson 7.4          | Mobile applications   |
| Lesson 7.5          | Wearable devices applications                                   |
| <b>Activity 7.6</b> | How to develop a mobile app                                     |
| Quiz 7              |   |

## MODULE 7. VIRTUALIZATION

|  |  |
|--|--|
| <b>Responsible</b>                         | Università Politecnica delle Marche (UNIVPM)   |
| <b>Contents</b>                            | 5 lessons + 1 activity + 1 quiz  |
| <b>Introduction and module description</b> | CH virtualization represents a challenge in terms of humanities and informatics skills. It is a tangible means for the enhancement and the narrative of museums' collections. The module 7 offers a concise and effective overview of the Extended Reality technologies and explains how they are employed in the sector of the app developing through the study of some of the best digital practice. The module 7 includes 5 lessons and 1 activity where you will be able to choose the most effective technologies based on some real case scenario and develop a simple mobile application. |

## Specific Competences addressed in the module

1. To be able to distinguish the main Extended Reality technologies for Cultural Heritage
2. To be able to define and evaluate the best XR solution basing on some real cases
3. To be able to ideate and develop simple applications for museums

## Learning objectives of the module

- 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

## Expected Learning outcomes

By the end of the module, students will be able to explain the 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 CH. 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 good knowledge of some common software. Furthermore, students will test an available platform for the development of new XR experiences for a museum collection.

## Video

Lesson 7.1

Lesson 7.2

[7.3.mp4](#)

[7.4.mp4](#)

[7.5.mp4](#)

## Text

Lesson 7.1

[7.1 Virtual Reality](#)

Lesson 7.2

7.2 Augmented & Mixed Reality

Lesson 7.3

[7.3 Applications on the web](#)

Lesson 7.4

[7.4 Mobile Applications](#)

Lesson 7.5

[7.5 Wearable device applications](#)

## Activities

## Activity 7.6

### 7.6 How to develop a mobile app

|                    |   |
|--------------------|---|
| <b>Tutor</b>       | Mirco D'Alessio, Daniele Arturo De Luca   |
| <b>Description</b> | In this tutorial all the steps to develop a simple mobile application exploiting Augmented Reality will be shown. |
| <b>Explanation</b> | Submit a video screen capture of the builded Application during the functioning                                   |

## Quiz/Self-assessment test

### Quiz 7

## Bibliography

### Lesson 7.1

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Adams @Gkendall, G.K. (2021) *Through the looking Glass: The VR Revolution in museums is here*, Museums Association. Available at: <https://www.museumsassociation.org/museums-journal/analysis/2021/05/through-the-looking-glass-the-vr-revolution-in-museums-is-here/>

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### Lesson 7.2

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- [11] I. Vasic *et al.*, "Virtualization and Vice Versa: A New Procedural Model of the Reverse Virtualization for the User Behavior Tracking in the Virtual Museums," pp. 329–340, 2022, doi: 10.1007/978-3-031-15553-6\_23.

#### Lesson 7.4

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- [2] <https://www.experenti.eu/realta-aumentata/arte/barcellona-casa-batllo-in-realta-aumentata/>
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[https://www.youtube.com/watch?v=06KMveAi60s&ab\\_channel=DistoriHeritage](https://www.youtube.com/watch?v=06KMveAi60s&ab_channel=DistoriHeritage)
- [2] A Night In The Forum Trailer  
[https://www.youtube.com/watch?v=9AvCQexNbrU&ab\\_channel=sofiapescarin](https://www.youtube.com/watch?v=9AvCQexNbrU&ab_channel=sofiapescarin)
- [3] Castel del Monte diventa un HoloMuseum  
[https://www.youtube.com/watch?v=QuwA9gpG5dA&t=91s&ab\\_channel=MicrosoftItalia](https://www.youtube.com/watch?v=QuwA9gpG5dA&t=91s&ab_channel=MicrosoftItalia)
- [4] Petersen Automotive Museum: a HoloLens experience  
[https://www.youtube.com/watch?v=DdM786eila8&t=5s&ab\\_channel=Microsoft](https://www.youtube.com/watch?v=DdM786eila8&t=5s&ab_channel=Microsoft)

|                     |   |
|---------------------|---|
| <b>AREA D</b>       | <b>Digital access: Universal design and virtual experiences</b> |
| <b>MODULE 8</b>     | <b>New frontiers in CH</b>                                      |
| Lesson 8.1          | Introduction to Artificial Intelligence                         |
| Lesson 8.2          | Machine learning  |
| Lesson 8.3          | Deep learning   |
| Lesson 8.4          | The role of AI in the Heritage Sciences dimension               |
| Lesson 8.5          | Evaluation questionnaires for museum experience                 |
| Lesson 8.6          | ICT for tracking behaviour                                      |
| <b>Activity 8.7</b> | Evaluation Questionnaires Developing                            |
| Quiz 8              |   |

|  |  |
|--|--|
| <b>MODULE 8. NEW FRONTIERS IN CH</b>       |  |
| <b>Responsible</b>                         | Università Politecnica delle Marche (UNIVPM)   |
| <b>Contents</b>                            | 6 lessons + 1 activity + 1 quiz  |
| <b>Introduction and module description</b> | Some of the new frontiers in CH will be discussed in this module. By using AI and XR technologies it is possible to implement sophisticated tracking of user experiences or automatized the 3d modelling processes that currently are mostly manual. |

### Specific Competences addressed in the module

1. To be able to distinguish the main AI technologies for Cultural Heritage
2. To be able to define most common assessment questionnaires
3. To be able to conduct a simple survey on a museum application

### Learning objectives of the module

- To explain terms like Machine Learning, Deep Learning and Neural Networks
- To become aware of best practices of AI in the 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

### Expected Learning outcomes

By the end of this module, students will learn what Artificial Intelligence (AI) is, explore concrete cases and applications of AI, 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 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 engagements and level of readiness. Finally, they will carry out an activity designing and producing a simple assessment questionnaire about a museum application.

## Video

Lesson 8.1

Lesson 8.2

Lesson 8.3

[8.4.mp4](#)

Lesson 8.5

Lesson 8.6

## Text

[Lesson 8.1](#)

[Lesson 8.2](#)

[Lesson 8.3](#)

[Lesson 8.4](#)

[Lesson 8.5](#)

[Lesson 8.6](#)

## Activities

### Activity 8.7

#### *8.7 Evaluation Questionnaires Developing*

|                    |   |
|--------------------|---|
| <b>Tutor</b>       | Andjela Djordjevic  |
| <b>Description</b> | In this activity all the steps in order to develop a simple questionnaire about a virtual tour using will be shown. Literature containing basic rules for creating questionnaires and formulating questions will be proposed to the students. |
| <b>Explanation</b> |   |

# Quiz/Self-assessment test

Quiz 8

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## Relevant material

None



# **ANNEX 3. Certificate**