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DELTA: Digital Excavation through Learning and Training in Archaeology
2019-1-EL01-KA203-062875
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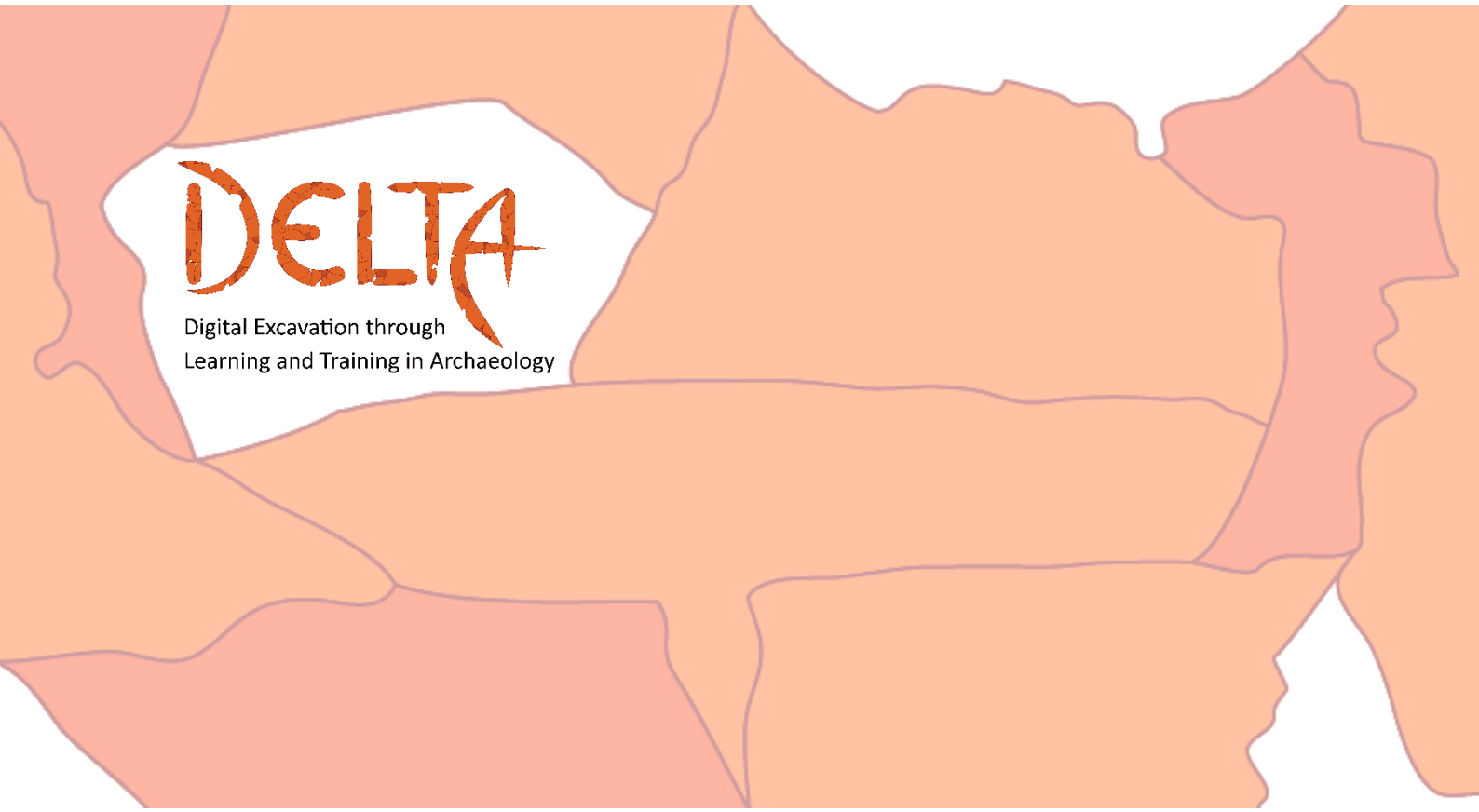

DELTA – DIGITAL EXCAVATION THROUGH LEARNING AND TRAINING IN ARCHAEOLOGY

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Work package:	IO1/A3
Type:	Document
Keywords:	DELTA project, digital skills, digital technologies, online course
Abstract:	This teaching handbook is intended to teachers and lecturers how to implement the whole DELTA course, its part or DELTA methodology into the curricula of any university. The handbook brings essential information on the learning techniques and how to enrich the classical teaching with interactive materials.
Authors:	Johana Malíšková, Peter Tóth (editors).

Template designed by:

DAISSY research group, Hellenic Open University (http://daissy.eap.gr/en/)

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Introduction

DELTA (*Digital Excavation through Learning and Training in Archaeology*) is a project funded by the Erasmus+ Programme of the European Union, Key Action 2: Cooperation for innovation and the exchange of good practices, strategic partnership in the field of education, training and youth. DELTA is a transnational project with four partners - Hellenic Open University (Patras, Greece), Universita Degli Studi Della Basilicata (Matera, Italy), National and Kapodistrian University of Athens (Greece) and Masaryk University (Brno, Czech Republic).

Project DELTA designed and developed an innovative, open and blended course that combines the physical space of archaeological excavation with the digital space of online learning. DELTA integrates the excavation site as an instructional tool in the classroom-based instruction of Archaeologists using digital means.

The project focused on developing digital competencies so that young and future archaeologists maximize the Academic return on investment (ROI of education), become more resilient, increase their creativity and efficiency and acquire career adaptive competencies [1]. The focus is put on the application of open-source software to emphasize the collaboration and data exchange between institutions and individuals and to minimize the financial costs of acquiring the software. The DELTA course introduced learners to the basics of these

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software and their application into the research, communication of research results or educational purposes.
The course was created in response to the incoherent way of teaching digital technologies in participating countries and was implemented through the online DELTA platform. The course consisted of four modules:

- Module 1: Digital Tools for Archaeological Practice/Excavation
- Module 2: Documentation in situ and after excavation
- Module 3: Digital preservation and presentation of cultural heritage monuments and artefacts
- Module 4: Open-Air Museums and Experimental Archaeology

Module 1 focuses on the potential of using contemporary technology in archaeological fieldwork, such as online resources, digital maps, measuring devices (total station, GNSS receiver) or 3D documentation methods during the fieldwork.

The objectives of Module 2 are to familiarize students with the basic principles and methods of documentation applied in situ and after excavation, such as principles of using and operating tools for digital recording, integration of various types of digital information into a single digital archive and working with digital data for the purposes of archaeological interpretation.

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Module 3 puts an emphasis on those techniques, which effectively produce, manage and visualize digital data for the preservation and presentation of cultural heritage, from the largest scale of entire buildings or archaeological sites and their surrounding landscape, down to the smallest scale of artefacts and ecofacts.

Module 4 introduces the students of Archaeology to the value of archaeological open-air museums, their management and their visitors. Learners will understand how the practice of experimental archaeology is strongly connected to growing craft experience.

This handbook is intended to teachers and lecturers how to implement the whole DELTA course, its part or DELTA methodology into the curricula of any university. The handbook brings essential information on the learning techniques and how to enrich the classical teaching with interactive materials.

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1. How to use the handbook

(Johana Malíšková, Peter Tóth)

This chapter provides guidance on how to use the handbook in teaching digital skills in the cultural heritage sector. In order to better understand the DELTA course, first, we need to explain the methodology and basic terms with which the course operates. Subsequently, the procedures of designing and developing educational material are also included in this part of the handbook.

The entire DELTA course consists of four major (course) modules (topics). The structure of the course divided into modules respects the traditional composition of MOOC courses, which usually take up to several weeks (Fig. 1).

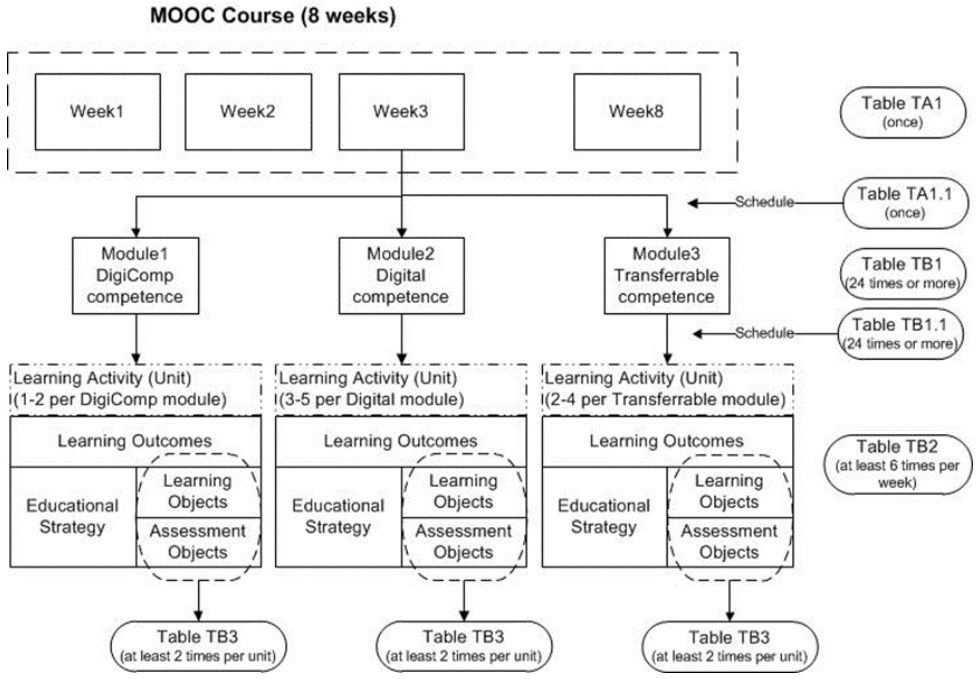

Fig. 1 – The example of a MOOC of 8 weeks - Analysis flowchart [2].

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The DELTA course is structured as a blended course that combines a physical space of archaeological excavation with the digital space of online learning. A course consists of an online part and face-to-face classroom activities that last for a total of 160 hours - 40 hours per each module, which are divided into 32 hours for online part and 8 hours for face-to-face activities in class. The DELTA course contains four modules. Under the term *module* we mean an independent thematic block (or larger topic) with a specific purpose. Each module is designed and developed as a series of learning elements (units, learning objects and learning outcomes).

Each module consists of 2 to 5 *units* (=learning activities), which are more thematically focused, which are related to each other. Units follow a specific educational strategy and consist of providing any combination of core learning objects (e.g., video, presentation, etc.), additional educational material (e.g., e-books, additional readings, etc.), collaboration objects (e.g., forum), or assessment objects (projects, self-evaluation exercises, quizzes) organized in a series of lessons (learning objects). The unit is actually a demonstration of how students are provided with knowledge according to the adopted educational strategy [2].

The main specificity of the chosen educational or training progress in the DELTA course lies in the adoption of *learning outcomes (LOut)* - a learning approach that is oriented to the learner. The main points of the "learner-centered" model are:

- what the learners will learn

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- what the learners will master
- what the learners will be able to do as they progress through the course

An important component of the presented approaches to writing learning outcomes was the application of the so-called *Bloom Taxonomy,* which includes three domains of learning - cognitive, affective and psychomotor, and consists of several levels (Fig. 2).

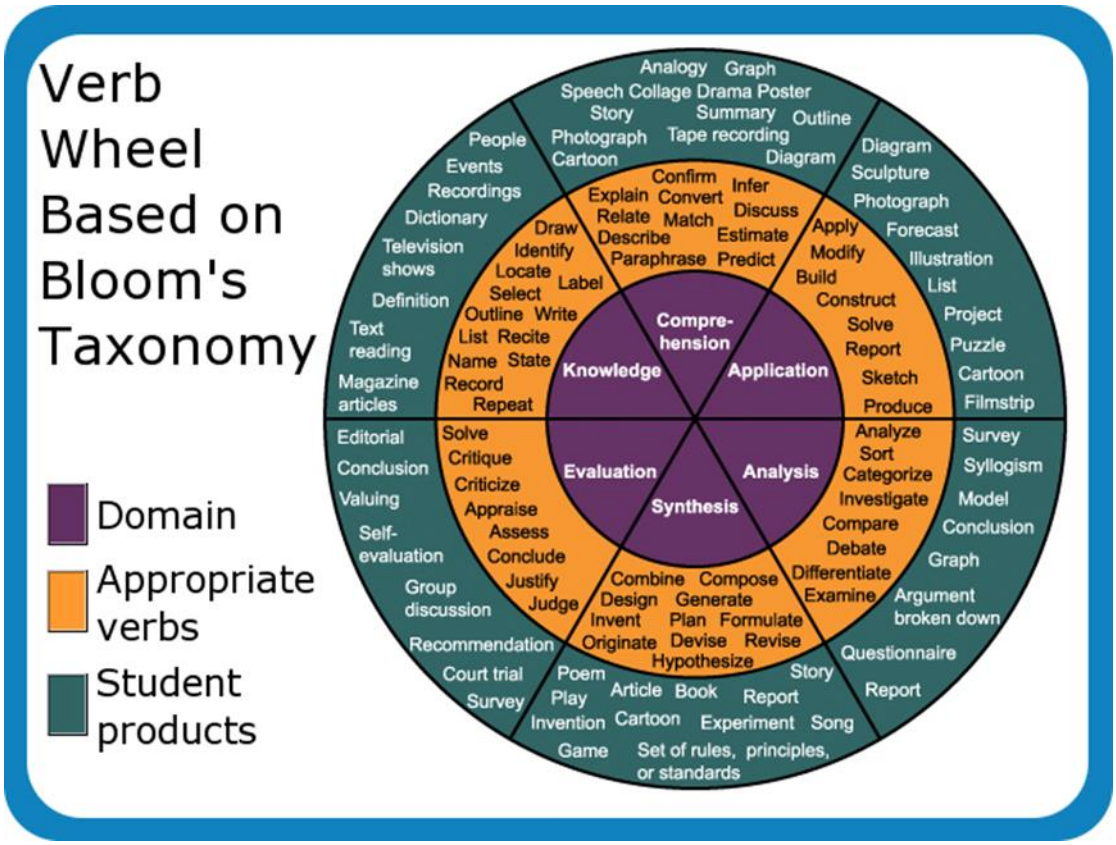

Fig. 2 – The verb wheel based on Bloom's taxonomy [5].

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According to the European Qualifications Framework [3] and Bloom's taxonomy [5], each learning outcome should [2]:

- refer to one and only level in Benjamin Bloom's taxonomy
- contain one and only one action verb
- contain one concept of the knowledge domain
- be observable, measurable and capable of being assessed

The last term to explain is the *learning object.* Simply put, a learning object is one lesson's own learning material. However, its creation was a subject to methodology so that the result should be specific and measurable in order to guide instructors and learners appropriately. According to Mager's the ABCD approach [4], well-written outcomes are [2]:

- the verbs comply with the Bloom's taxonomy (Cognitive, affective, psychomotor domains)
- the specification of *condition* should be detailed enough
- indicators of degrees of mastery (performance) include the time limits, accuracy, quality

Another approach, the so-called SMART approach emphasizes the clarity and correctness of the definition of outcomes, use of action verbs, specification of the time frame etc.

The methodology for designing and developing the DELTA course followed the ADDIE model (Analysis, Design, Development, Implementation and Evaluation). In the first step, the *analysis* phase was executed. At the very beginning, attention was focused on the

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training problem in order to specify the purpose of training, the knowledge domain, the main learning goals, the basic learning objectives, the learners' profile and the timeframe of the training process or other special needs [2].

The analysis phase is followed by the *design* phase, the purpose of which is to define and describe the individual detailed learning objectives for each module, the units (learning activities) in which each module is divided, the educational strategy that will be applied in each unit and the learning outcomes of that unit [2]. In this part of the course design, it was also necessary to develop a way of evaluating students. The educational strategy outlined above is reflected in all phases of the course design and demonstrates the ways in which learners acquire and practice their knowledge and skills in selected areas. The design phase aimed to:

- describe each course Module
- describe each unit (learning activity) per course Module
- describe each learning object per unit (learning activity)
- describe learner assessment of the Unit in each Module

A specific flowchart was defined, which meant that each output was evaluated at three levels - the role of author, technical reviewer and scientific reviewer. This ensured the required quality and expertise of outputs (Fig. 4).

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1	Course (MOOC) title	***Digital Excavation through Learning and Training in Archaeology***
2	Course description	
3	Knowledge domain	
4	Educational strategy	
5	Course addressed to	
6	Course type	
7	Learning goals[1]	
8	Basic learning objectives	
9	Course length	
10	Course schedule (course modules codes, titles and description)	
11	Learners' profile	
12	Learners' background knowledge	
13	Participation prerequisites	
14	Access to the educational environment	

Fig. 3 - DELTA Course Description (Analysis Phase).

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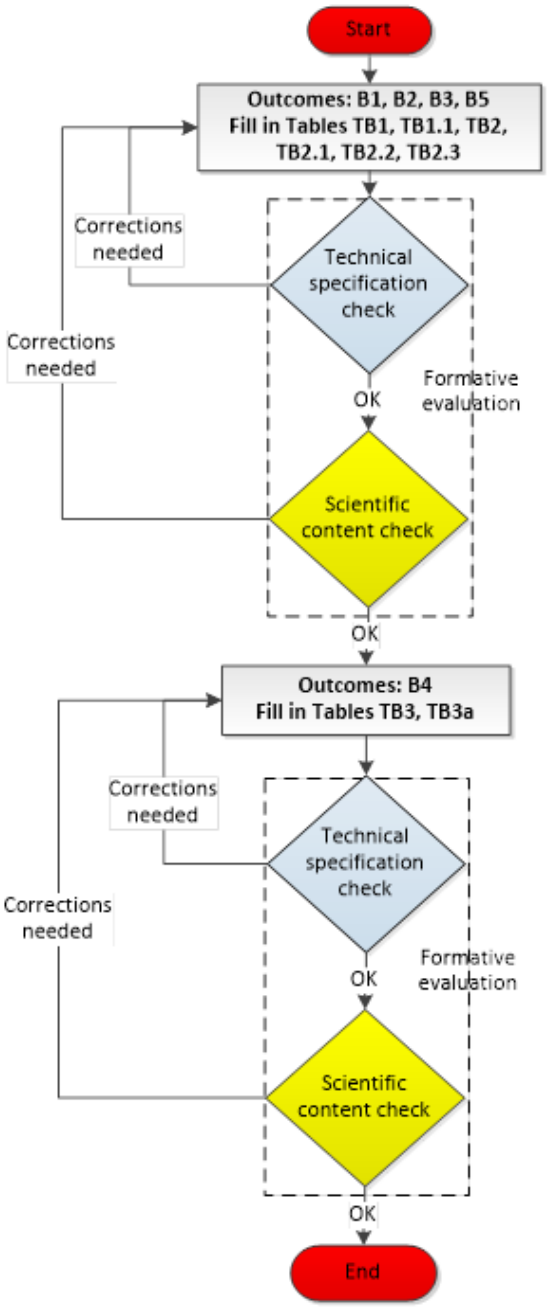

Fig. 4 – DELTA course design flowchart [2].

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The *development* phase follows. This phase of the course already included the specific production of individual educational materials, so-called learning objects. These included not only individual basic learning materials (in our case, presentations accompanied by voiceover), but also a number of additional supportive material, collaboration and assessment learning objects (Fig. 5).

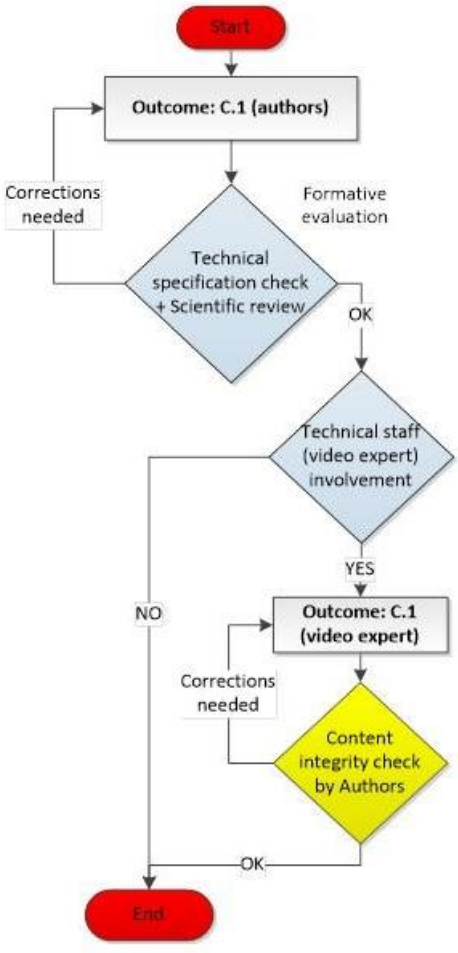

Fig. 5 – DELTA course Development flowchart [2].

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An important part was the *implementation* phase. The primary goal was the general dissemination of DELTA course awareness, including publishing through various platforms, whether social networks, advertising, communities and email DBs, newsletters and relevant culture websites, or presenting the course at conferences. Before delivering the course, a pilot test took place, which was focused on the test functionality of the platform in an effort to capture all possible shortcomings. The participants in the pilot testing could be a small number of learners or the experienced scientific staff (trainers). And then came the realization phase of the educational process, which was based on the active support of tutors throughout the course.

The final part of the proposed methodology was its *evaluation*, which took place in two phases, 1. formative assessment, which aimed to estimate the correct implementation of each step of the development process and to verify the scientific quality of the course, and then 2. summative assessment, which was the final assessment measuring the effectiveness of the educational procedure [2].

1.1 Bibliography

[1] P. Polymeropoulou – A. Kameas – I. Papadatos – A. Kalara – F. Sogliani – D. Roubis – P. Tóth – J. Malíšková 2021: Digital applications in archaeological education and excavation training: the DELTA course. In: ICERI2021 Proceedings. ISBN: 978-84-09-34549-6. doi: 10.21125/iceri.2021

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[2] Ch. Pierrakeas - A. Kameas - P. Polymeropoulou 2020: IO1. A1 Instructional methodology for the DELTA Course. Design and development of educational content.

[3] Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03).

[4] Mager, R. F. (1984). Preparing instructional objectives, 2nd edition. Belmont, California: Pitman Learning.

[5] http://2.bp.blogspot.com/_337GUHQH0FY/SmpJpr5va5I/AAAAAAAABmU/UFiQn59gIT8/s1600-h/bloomwheel.png

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2. Digital Tools for Archaeological Practice/Excavation (Module 1)

(Peter Tóth, Johana Malíšková, David Hons, Vojtěch Nosek, Dalia Pokutta)

The module 1 *Digital tools for archaeological practice/excavation* addressed the needs of professionals in the field of archaeology that would like to exploit the potential of contemporary technologies in order to accomplish their current and future work duties concerning field work. In this regard, trainees will be able to:

- plan a fieldwork using available digital tools and online data sources
- operate measuring devices, acquire and produce digital spatial data
- transfer digital data between measuring device and computer
- manage, analyze and visualize measured data digitally

Module 1 is divided into 4 thematic blocks (units) – *Before excavation, Geodesy, Geographic information systems and 3D visualization techniques.* After completing the course the trainee learns about non-destructive and remote sensing techniques used to specify the site for excavation, basic geodesy principles, geographic information systems or image based modeling.

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2.1 Before excavation (Module 1, Unit 1)

(David Hons, Johana Malíšková, Vojtěch Nosek)

The unit covers the following topics:

- what is LiDAR
- data types and data sources for LiDAR
- LiDAR data processing and analysis
- interpretation of LiDAR
- what is geophysics (principles and basic equipment)
- data collecting
- analysis of geophysical data
- interpretation of geophysical survey
- use of online maps for archaeological research

The first learning object (1.1.1a) introduces learners what LiDAR stands for, basic principles of LiDAR technology, data types and their sources. In this learning object there will be a definition of LiDAR technology and introduction to the basic principles. Explanation of data types and the availability of the data sources are integral to this learning object. Operation manual of how to find and manage online LIDAR data is part of the course.

Next learning object (1.1.1.b) introduces learners' practical ways to take charge of LiDAR data, formats and coordinate systems, data processing including a sample of immersive visualization and analysis of LiDAR data. In this learning object there will be a focus on the

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processing of LiDAR data, data editing and data classification. The procedure of working with data in different stages of data processing, formats and coordinate systems will be explained in an illustrative way. In this case, LiDAR producing mass point cloud datasets will be managed, visualized, analyzed, and shared using appropriate software.

The third learning object (1.1.1c) focus on interpretation of LiDAR data. In the form of case studies, students will be shown the use of LiDAR data in archaeology and their comparison/cooperation with other archaeological methods and procedures. The case studies will demonstrate the advantages and disadvantages of LiDAR data and interpretation difficulties (e.g., problems with interpretation under vegetation, etc.). The advantages and disadvantages of this method will be presented. The case studies will demonstrate the advantages and disadvantages of LiDAR data and interpretation difficulties (e.g., problems with interpretation under vegetation, etc.).

The fourth learning object (1.1.1d) introduces learners what a geophysical survey is used for, how it works and what are the basic geophysical methods, their possibilities, and possible disadvantages of this form of survey.

Next learning object (1.1.1e) introduces students how to collect, analyze, visualize, and present geophysical survey results. The whole process is demonstrated on selected case studies. The learning object

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introduces students to a manual on how to collect, examine, visualize and present geophysical survey results. In selected case studies, identifying potential archaeological deposits through geophysical survey is compared with results of archaeological excavation. This manual is available online.

The last learning object (1.1.1f) introduces learners how to use, analyze and interpret archaeological relics visible on satellite imagery or historical maps in the environment of online maps. In this learning object will be introduce use of online map from various sources (Google Earth, mapy.cz etc.). There will be a demonstration how to use, analyze and interpret archaeological relics visible on satellite imagery and historical maps.

2.1.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 1.1.1.a: a presentation on principles of laser-scanning, data types and sources
- 1.1.1.b: a video on how to process and analyze LIDAR data
- 1.1.1.c: a presentation on how to interpret LIDAR data
- 1.1.1.d: a presentation on basic geophysical survey principles and equipment
- 1.1.1.e: a video on how to collect, analyze, interpret and present geophysical data

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- 1.1.1.f: a presentation on how to use online maps for archaeological research
- 1.1.1.g: study of a learning material (a handbook)

2.1.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut1: state basic principles of LiDAR surveying
- LOut2: find LiDAR data
- LOut3: analyze LiDAR data
- LOut4: interpret LiDAR data
- LOut5: define principles of geophysical survey
- LOut6: examine geophysical data
- LOut7: interpret geophysical data
- LOut8: use online maps

2.1.3 Learning techniques

Among the learning techniques to acquire the ability to use available online resources for remote sensing techniques, interpret results of non-destructive methods or combine digital data for deciding the places for excavation, will include:

- studying of learning material (a handbook)
- watching a presentation on principles of laser-scanning, data types and sources
- watching a video on how to process and analyze LiDAR data
- watching a presentation on how to interpret LiDAR data

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- watching a presentation on basic principles of geophysical prospection and necessary equipment for surveying
- watching a video on how to collect, analyze, interpret and present geophysical data
- watching a presentation on how to use online maps for archaeological research

2.1.4 Further reading and watching

M1.1.1. What is LIDAR and how does it work?

A.S.Z. Chase, D.Z. Chase and A. Chase: "LiDAR for Archaeological Research and the Study of Historical Landscapes". In: Sensing the past, 2017. DOI: 10.1007/978-3-319-50518-3_4. Available online at:
https://www.researchgate.net/publication/316050897_LiDAR_for_Archaeological_Research_and_the_Study_of_Historical_Landscapes

M1.1.2 How to work with LiDAR data - from cloud to landscape

YouTube videos:
https://www.youtube.com/watch?v=GXb8QPumFjo&t=742s&ab_channel=IU_PTI
https://www.youtube.com/watch?v=9LUuMYzwjfI&ab_channel=HansvanderKwast

M1.1.3. How to interpret LiDAR data for the needs of archaeological survey?

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Article by A. Guyot, M. Lennon and T. Lorho, L. Hubert-Mo, "Combined Detection and Segmentation of Archeological Structures from LiDAR Data Using a Deep Learning Approach". Journal of Computer Applications in archaeology 4(1):1, 2021. DOI:10.5334/jcaa.64.

M1.1.4. What is geophysics in archaeology?

Article by T. Herbicha, "Magnetic prospecting in archaeological research: a historical outline", Archaeologia Polona, vol. 53: 2015, 21-68.

Article by P. Milo, J. Zeman, M. Bartík a M. Kuča, "Late Neolithic circular enclosures: never entirely uncovered", Archaolologia Polona 53 (2015), 253-258.

Article by J. C. Wynn, "A review of geophysical methods in archaeology", Geoarchaeology: An International Journal, Vol. 1, No. 3, 245-257.

Article by M. S. Zhdanov, "Electromagnetic geophysics: Notes from the past and the road ahead", Geophysics, vol. 75, no. 5 September-October 2010; DOI: 10.1190/1.3483901

M1.1.5. Geophysical survey - from measurement to presentation

Article by P. Milo, "Sídliská a sídliskové objekty na lokalite Těšetice-Kyjovice "Sutny" z pohľadu geomagnetickeho prieskumu", Studia archaeologica Brunensia. 2013, roč. 18, č. 1, 71-91.

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Article by R. Sala, E. Garcia-Garcia and R. Tamba, "https://www.researchgate.net/publication/236134825_Archaeological_Geophysics_-_From_Basics_to_New_Perspectives". In: I. Ollich: Archaeology, New Approaches in Theory and Techniques, 133-166.

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2.2 Geodesy (Module 1, Unit 2)

(Peter Tóth)

The unit covers the following topics:

- total station
- RTK GNSS
- basic geodesy principles for different measurement scenarios
- exchange data between measuring devices and computer

In the introduction of Unit 2 (1.1.2.a) we will focus on the total station. The learning object introduces learners how to set up a total station and basic principles of operating the total station. There will be a manual on how handle the total station from the very beginning. Total station will be introduced and there will be shown best practices on how to quickly set up a tripod and how to position the total station. Operation manual of the total station is part of the course. This manual is available online.

Next learning object (1.1.2b) introduces learners how to set up a RTK-GNSS rover and basic principles of operating the RTK-GNSS rover. In this learning object there will be a manual on how handle the RTK-GNSS from the very beginning. RTK-GNSS will be introduced and there will be shown best practices on how to assemble the set, establish the connection with satellites and read horizontal and vertical positioning errors. Operation manual of the RTK GNSS will be demonstrated. This manual is available online.

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The third learning object (1.1.2c) introduces learners how to handle different measurement scenarios. In this learning object there will be a manual on how to use total station and RTK-GNSS receiver in various measurement scenarios. There will be explained, what needs to be considered before a measurement job, how to select an appropriate coordinate system and where to find information about the system of fundamental and minor horizontal geodetic controls. There will be demonstrated how to station the total station (free stationing) and how to set out its orientation using traverse and how to sake-out predetermined points and measure points using total station and RTK-GNSS receiver. This manual is available online.

Last learning object (1.1.2d) introduces learners how to download data from total station/RTK-GNSS receiver as well as how to prepare the data in computer and upload it to measuring devices. In this learning object there will be a manual on how to download data from either total station or RTK GNSS, how to edit the downloaded data and visualise it in GIS. There will be also demonstrated how to prepare data in the computer and how to upload this data back to total station or RTK GNSS. This manual is available online.

2.2.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

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- 1.1.2.a: video on operation of total station
- 1.1.2.b: video on operation of RTK GNSS
- 1.1.2.c: presentation on various measurement scenarios
- 1.1.2.d: presentation on data exchange
- 1.1.2.e: chapter in a handbook

2.2.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut9: operate the total station
- LOut10: operate the RTK GNSS
- LOut11: apply the optimal strategy for different measurement scenarios

2.2.3 Learning techniques

Among the learning techniques to acquire the ability to apply of the optimal strategy for different measurement scenarios, operate various measuring devices, exchange data between measuring devices and computer, will include:

- study of learning material (a handbook)
- watching a video on how to operate total station
- watching a video on how to operate RTK GNSS
- watching one presentation on basic geodesy principles
- watching one video on how to perform data exchange between measuring devices and computer

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2.2.4 Further reading and watching

M1.2.1 What is a total station?

Youtube video

- interactive guide about different parts of the total station and its function

M1.2.2 What is a GNSS receiver?

Article by P.J. Cobb, T. Earley-Spadoni and P. Dames, "Centimeter-Level Recording for All: Field Experimentation with New, Affordable Geolocation Technology", Published online by Cambridge University Press: 13 August 2019.

- a case study about using precise differential GNSS during surface survey in Armenia in 2018

M1.2.4 Exchanging data with the computer

Article by S.W, Kansa et al, "Archaeological Analysis in the Information Age: Guidelines for Maximizing the Reach, Comprehensiveness, and Longevity of Data", Advances in Archaeological Practice 8(1):1-13, October 2019, DOI:10.1017/aap.2019.36

- guidelines on how to best manage data and share them to maximize the reach and reusability of information

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2.3 Geographic information systems (Module 1, Unit 3)

(Peter Tóth)

The unit is covering these areas:

- what is GIS
- overview of available software
- data types
- managing spatial data
- visualizing data
- creating digital drawings
- production of digital outputs

The first learning object (1.1.3a) introduces learners what is GIS and what is a philosophy behind GIS. In this learning object there will be an introduction on what is GIS, what is the philosophy behind GIS, short history of GIS and the definition of GIS. This manual is available online.

The second learning object (1.1.3b) introduces learners basic data types, data sources and gives an overview of the most common GIS software. In this learning object there will be an introduction of basic building blocks of GIS, which are vectors and rasters. Presented will also be various data sources offering digital data used by GIS softwares. An overview of the most common GIS software (open source, commercial) will be given. This manual is available online.

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Next learning object (1.1.3c) introduces basic techniques on how to best manage the spatial data stored in the computer. In this learning object there will be a manual on how to best manage spatial data stored in your computer. Various file formats will be introduced, such as file geodatabase, personal geodatabase, shapefile and geopackage. Their advantages and disadvantages will be presented with respect of used software and possibilities of their future updates. Several relation techniques to put together data from different sources, as well as adding data, merging and splitting datasets will be demonstrated. This manual is available online.

The fourth learning object (1.1.3d) introduces learners' basic principles on how to visualize data with respect to the needs of archaeological excavation. In this learning object there will be a manual on how to change the symbology of vector and raster layers based on different needs for data analysis and how to use labels of vector layers. This manual is available online.

The penultimate learning object (1.1.3e) introduces learners how to georeference and digitize data sources and how to create drawings. In this learning object there will be a manual on how to georeference and digitize data produced by photogrammetry or scanning of paper maps. There will be shown a demonstration of a procedure of creation of drawings using points, lines and polygons. This manual is available online.

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The last learning object (1.1.3f) introduces learners how to produce a digital map. In this learning object there will be a manual on how to create a digital map. There will be a demonstration on how to add map elements to the map, such as legend and scale and how to export the resulting output into various formats. This manual is available online.

2.3.1 Learning objects

Core learning objects are a combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 1.1.3.a: introductory presentation (what is GIS)
- 1.1.3.b: presentation on data types and software
- 1.1.3.c: video about managing spatial data
- 1.1.3.d: video about analyzing spatial data
- 1.1.3.e: video about creating digital drawings
- 1.1.3.f: video about producing digital outputs
- 1.1.3.g: chapter in a handbook

2.3.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut13: state basic principles of GIS
- LOut14: define basic data types
- LOut15: manage spatial data using geographic information

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system

- LOut16: visualize vector and raster data
- LOut17: create digital drawings

2.3.3 Learning techniques

Among the learning techniques to acquire the ability to manage spatial data using geographic information system, create digital drawings, produce digital maps, will included:

- studying of learning material (a handbook)
- watching an introductory presentation to GIS (what is GIS)
- watching one presentation to data types and available software
- watching a video on how to manage spatial data
- watching a video on how to visualize spatial data
- watching a video on how to create digital drawings
- watching a video on how to produce digital outputs

2.3.4 Further reading and watching

M1.3.1 What is GIS?

Chapters 1 and 2 by V. Olaya, "Introduction to GIS". London 2018, England: Bradbury and Evans, 1851.

- more in-depth information about the GIS and its history and principles

M1.3.2 Data and GIS software

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Chapters 4-6 by V. Olaya, "Introduction to GIS". London 2018, England: Bradbury and Evans, 1851.

- more in-depth information geographical data, data sources and software

YouTube video

- various techniques of capturing digital data in archaeological fieldwork

M1.3.3 Managing spatial data

QGIS documentation

- manual on adding, operating and managing data

M1.3.4 Data visualisation

Chapter 9 by V. Olaya, "Introduction to GIS". London 2018, England: Bradbury and Evans, 1851.

- best practices on visualisation of spatial data

M1.3.5 Creation of digital drawings

Chapter 5 by V. Olaya, "Introduction to GIS". London 2018, England: Bradbury and Evans, 1851.

- best practices on digitisation

M1.3.6 Production of digital maps

Chapter 9 by V. Olaya, "Introduction to GIS". London 2018, England: Bradbury and Evans, 1851.

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- best practices on creating maps and visualisation of geographic data with some examples

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2.4 3D visualisation techniques (Module 1, Unit 4)

(Vojtěch Nosek, David Hons, Johana Malíšková)

The first learning object (1.1.4a) introduces learners how to acquire photos using DSLR camera or UAV camera and basic principles of data acquisition strategies. In this learning object there will be a manual on how to acquire photos for Image based modelling 3D data produce from scratch. Basic principles of Structure from Motion photogrammetry will be introduced and there will be shown how to operate DSLR camera or UAV and optimal strategies for photo shoot.

Next learning object (1.1.4b) show how to set up a process acquired photos, basic principles of Image based Modelling software and 3D model reconstruction workflow. In this learning object there will be a manual on how to process photos acquired in the field. Basic structure from Motion reconstruction process will be introduced and there will be shown best practices on how to process photos from different terrain situations.

The third learning object (1.1.4c) introduces learners how to acquire data from field in best way adapting the surroundings of the object of interest and improvising during data acquisition and processing. In this learning object there will be a manual on how to use different approaches of ground photoshoot and remote sensing using UAV. Common mistakes will be explained and best way how to acquire precise and reliable 3D model will be explained.

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The fourth learning object (1.1.4d) introduces learners how to interpret different measured 3D spatial models. In this learning object there will be a manual on how to interpret processed data and reconstructed 3D models. There will be demonstrated how to avoid mistakes that have been made and how to correct 3D model errors.

The last learning object (1.1.4e) introduces learners how to produce basic spatial analysis of the 3D models and how to make simple reconstruction and interpretation model based on measurement. In this learning object there will be a manual on how produce basic spatial analysis of the 3D models and how to visualise specific areas of interest in produced 3D model. In the second part simple reconstruction and interpretation model based on measurement will take place.

The unit is covering these areas:

- 3D documentation application
- data types
- data acquisition strategies, involving DSLR camera and UAV
- data processing, storage and edit
- 3D spatial data analysis
- reconstruction of the past – relics interpretation

2.4.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

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- 1.1.4.a: a presentation on principles Image based modeling, visualization techniques, data types and acquisition
- 1.1.4.b: a video on how to process and analyze acquired data
- 1.1.4.c: a presentation on how to interpret remote sensing data
- 1.1.4.d: a presentation on data acquisition principles, equipment, and strategies
- 1.1.4.e: a video on how to analyze and visualize spatial data
- 1.1.4.f: a presentation on how to interpret and reconstruct relics of the past based on acquired data
- 1.1.4.g: chapter in a handbook

2.4.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut19: understand Image based modeling surveying principles
- LOut20: produce Image based modeling data
- LOut21: analyze spatial data produced by remote sensing methods
- LOut22: interpret data acquired by remote sensing methods

2.4.3 Learning techniques

Among the learning techniques to acquire the ability to operate 3D scanners in the field, apply the optimal strategy for documenting field situations through photogrammetry, process data produced by 3D

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visualization techniques, produce digital outputs made by 3D visualization techniques, will include:

- studying of learning material (a handbook)
- watching a presentation on principles of Image based modeling, data types and visualization techniques
- watching a video on how to process and analyze data in the environment of software
- watching a presentation of how to interpret remote sensing data
- watching a presentation on data acquisition principles, equipment, and strategies
- watching a video on how to analyze spatial data
- watching a presentation of how to interpret and reconstruct relics of the past based on acquired data

2.4.4 Further reading and watching

M1.4.1 Principles of image-based modelling, data types and photo acquisition techniques

- Watch a video with examples of IbM modelling.
- Watch a video-manual for IbM.

M1.4.2 Image based modeling data acquisition

- Watch three videos with example of data acquisition:

Video 1

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Video 2

Video 3

M1.4.3 Image based modeling data processing

- Watch a tutorial: Meshroom for Beginners.
- Watch a video: Fotogrammetrie 2 – 3D skenování jednodušší než kdy dřív!

M1.4.4 Remote sensing data interpretation

- Read a case study: Interpreting in 3D. Employing 3D modeling in field archaeology from research and public communication perspectives.

M1.4.5 Spatial data analysis and reconstruction of the past

- Read an article by J. A. Barceló et al. 2003: case study about creating a 3D model of an excavation and using it for understanding stratigraphic sequence

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3. Documentation in situ and after excavation (Module 2)

(Yiannis Papadatos, Antigoni Kalara, Alexandra Katevaini)

Excavation, as an irreversible and destructive process, requires consistent, accurate and detailed documentation and recording. These are an essential part of any archaeological project because they allow the reconstruction of the excavation process and the archaeological interpretation afterwards. Therefore, trainees should be able:

- familiarize with the basic principles and methods of documentation applied in situ and after excavation
- learn the use and operate tools for digital recording, namely tablets and the relevant software for filling digital notebooks and/or recording sheets
- integrate varied types of digital information (texts, drawings, images, orthophotos) into a single digital archive
- manage, analyze and visualize the digital data, which is kept in the form of databases, for the purposes of archaeological interpretation.

Module 2 is divided into 4 thematic blocks (units) – *The importance of archaeological documentation in situ and after excavation*, *Digital documentation in situ*, *Digital documentation after the excavation*, and *Post-excavation analysis of digital archaeological data*. The

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trainees learn about the importance of digital documentation in situ and after the excavation, hot to create and use digital data collection forms, how to manage the collected excavation data, and how to transfer the data and carry out basic GIS analysis.

3.1 The importance of archaeological documentation in situ and after excavation (Module 2, Unit 1)

(Yiannis Papadatos, Antigoni Kalara)

The unit covers the following topics:

- Archaeological documentation
- Excavation methodology and terminology
- Archaeological documentation: methods, tools and techniques

The first learning object (2.1.1.a) introduces learners to the concept of archaeological documentation. It deals with the destructive aspect of archaeological excavations in order to discuss the crucial importance of documentation in archaeological field projects. Also, it deals with the reasoning and the aims of archaeological documentation.

The second learning object (2.1.1.b) concerns the basic principles of excavation methodology. It describes the different types and methods of excavation and discusses various aspects of the excavation process. It introduces and explains basic excavation concepts such as site formation processes, s

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tratigraphy and context, deposit, fill, cut, surface, unit and locus.
The third learning object (2.1.1.c) concerns the basic methods, tools and techniques of archaeological documentation during and after the excavation. It deals with tools and techniques such as the excavation diaries and recording sheets, the excavation drawings and photos, and the drawings and photos of finds. Also, it presents the different tools and techniques used for different excavation methods.

3.1.1 Learning object

The main learning object used of Unit M2.1.1. are:

- 2.1.1.a: The relevant chapters in the teaching handbook
- 2.1.1.b: The relevant video presentations, directly related to the above chapters
- 2.1.1.c: Optional bibliography for further reading

3.1.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut1: Define five excavation concepts and principles of archaeological stratigraphy
- LOut2: Name three tools and/or techniques used for documentation in situ and after the excavation
- Lout7: Explain the concept of archaeological documentation
- Lout16: Compare two different excavation methods and their associated documentation methods

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3.1.3 Learning techniques

The learning techniques include:

- studying of learning material (chapters in the handbook)
- watching the relevant presentations of Unit M2.1
- reading the suggested optional bibliography

3.1.4 Further reading and watching

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12. B.G. Trigger, *A History of Archaeological Thought*, Second Edition, Cambridge: Cambridge University Press, 2008.
13. A. Westman (ed.), *Archaeological Site Manual*, Third Edition, London: Museum of London, Archaeology Service, 1994. https://web.archive.org/web/20170422211606/https://achill-fieldschool.com/wp-content/uploads/2016/01/molasmanual942.pdf

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3.2 Digital archaeological documentation in the excavation field (Module 2, Unit 2)

(Yiannis Papadatos, Antigoni Kalara, Alexandra Katevaini)

This unit focuses on the use of digital tools for documentation in the field, during the excavation; it demonstrates the advantages of digital documentation over the traditional (i.e. non-digital) recording techniques. Central issue is the use of databases, and their value for the collection and management of data. Following this session, the learner will understand the importance of digital documentation and the potential of digital tools for excavation projects in the 21st century.

The unit covers the following topics:

- Introduction to the concept of digital documentation and its potentials/advantages
- Types of digital documents (texts, drawings, maps, images, photos, orthophotos, 3d models)
- Digital recording techniques and tools applied in situ: hardware (tablets, laptops, mobile phones) and software
- The importance and value of databases, particularly pf relational integrated databases, for an archaeological project
- How to create digital collection forms and digital excavation diaries with the use of ODK and KoBoToolbox software
- How to document diverse archaeological contexts and features with the use of digital tools

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In the first learning object (2.1.2.a) we will introduce learners to the concept of digital archaeological documentation. It deals with the destructive aspect of archaeological excavations in order to discuss the crucial importance of digital documentation in archaeological field projects. It compares digital to non-digital methods of documentation and discusses their advantages and disadvantages.

The second learning object (2.1.2.b) object concerning the various tools and techniques used in the excavation field for digital documentation. It deals with digital methods of documentation, including diaries, recording sheets, drawings, photos, 2d orthophotos and 3d photogrammetric models. It also presents the various types of digital data produced by these digital methods. Also, it presents the ways digital tools and techniques are employed by different methods of excavation for recording different types of contexts.

The third learning object (2.1.2.c) introduces learners to the concept of digital databases and their importance for the management, processing and interpretation of archaeological data. It deals with the main aspects of databases, namely classification, storage and management of data. Special attention is given to the way databases are used in archaeological projects, and the advantages they offer for data processing and for the interpretation of excavation evidence. Emphasis is given on the special features of relational integrated databases, particularly open source relational SQL databases.

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The last learning object (2.1.2.d) deals with applications used for making data collection forms, with emphasis on free open-source applications. Various free open-source applications are presented and discussed, and one of them (KoBoToolbox) is used for making a data collection form suitable for the excavation field. The fields, which will be included in the form, are selected from the entities and properties discussed in Unit M2.1 (Learning objects M2.1.b and M2.1.c).

3.2.1 Learning object

The main learning object used of Unit M2.2 are:

- 2.1.2.a: The relevant chapters in the teaching handbook
- 2.1.2.b: The relevant video presentations, directly related to the above chapters
- 2.1.2.c: Optional bibliography for further reading
- 2.1.2.d: Optional visit to suggested websites for further information and for downloading open-access free software

3.2.2 Learning outcomes

Upon completion of this course, the learners will be able to:

- LOut3: Describe three tools used for digital documentation in situ
- LOut4: Present three types of digital documents produced by archaeological documentation in situ
- LOut8: Review four advantages of digital over non-digital archaeological documentation
- LOut9: Discuss three advantages of the use of databases in

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an excavation project

- LOut10: Use a data collection form to document two different archaeological contexts
- LOut13: Create a data collection form suitable for digital documentation in the excavation field

3.2.3 Learning techniques

The learning techniques include:

- studying of learning material (chapters in the handbook)
- watching the relevant presentations of Unit M2.2
- reading the suggested optional bibliography
- visit the suggested websites

3.2.4 Further reading and watching

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14. A. Rabinowitz, Response: Mobilizing (Ourselves) for a Critical Digital Archaeology, in E.W. Averett, J.M. Gordon, and D.B. Counts (eds.), *Mobilizing the Past for a Digital Future: The Potential of Digital Archaeology*, 493-520. The Digital Press. The University of North Dakota, 2016. https://thedigitalpress.org/mobilizing-the-past-for-a-digital-future/#Download
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3.3 Digital archaeological documentation after the excavation (Module 2, Unit 3)

(Yiannis Papadatos, Antigoni Kalara, Alexandra Katevaini)

This unit focuses on the use of digital tools for documentation after the excavation, for tasks such as the management, storing, conservation, recording and study of various types of material remains; it demonstrates the advantages of digital documentation over traditional, non-digital recording techniques. Following this session, the learner will understand the importance of digital documentation for the study of excavation finds after the excavation.

The unit covers the following topics:

- Introduction to the concept of digital documentation after the excavation, its potentials and advantages
- Types of digital documents (texts, drawings, images, photos, 3d photos)
- Digital recording techniques and tools used after the excavation: hardware (tablets, laptops, mobile phones) and the software
- How to create digital collection forms and laboratory logbooks with the use of ODK and KoBoToolbox software for post-excavation recording
- How to document various types of finds with the use of digital tools

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The first learning object (2.1.3.a) introduces learners to the concept of digital archaeological documentation after the excavation. It deals with the works, tasks and study which are normally carried out at the dig house, the laboratory, the office and/or the library. These works usually comprise conservation, drawing, photographing and recording of finds. It discusses the crucial importance of digital documentation, particularly for the integration of various types of digital data collected during and after the excavation. Also, it discusses the advantages and disadvantages of digital documentation and compares it with non-digital methods of documentation. Finally, it discusses entities and properties of finds, which are usually recorded during post-excavation study.

The second learning object (2.1.3.b) presents the various tools and techniques of digital documentation, which are used in the excavation laboratory, and the various types of digital data they produce. More specifically, it deals with digital methods of documentation, including recording forms, digital drawings, digital photos and 3d models of finds. It also presents the various types of digital data produced by these digital methods. Furthermore, it presents the ways digital tools and techniques are employed for documenting different categories of finds after the excavation.

The third learning object (2.1.3.c) deals with applications used for making data collection forms, with emphasis on free open-source applications and the creation of digital forms for post-excavation

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recording. Based on knowledge acquired during learning object M2.2.d, the KoBoToolbox application is used for the making of a series of data collection forms suitable for documenting excavation finds during their post-excavation study in the laboratory and/or the office. The fields, which will be included in the form, are selected from the entities and properties discussed in learning object M2.3.a.

The fourth learning object (2.1.3.d) discusses how to use data collection applications for digital documentation of finds after the excavation. Special attention is given to the various types of recording sheets used for the documentation of different types of finds (e.g. pottery, metals, organic finds), and various types of tasks (e.g. conservation, drawing, photographing and describing). The data collection forms which are used, are those produced during the practice of learning object M2.3.c.

3.3.1 Learning object

The main learning object used of Unit M2.3 are:

- 2.1.3.a: The relevant chapters in the teaching handbook
- 2.1.3.b: The relevant video presentations, directly related to the above chapters
- 2.1.3.c: Optional bibliography for further reading
- 2.1.3.d: Optional videos for further watching
- 2.1.3.e: Optional visit to suggested websites for further information and for downloading open-access free software

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3.3.2 Learning outcomes

Upon completion of this course, the learners will be able to:

- LOut5: List two tools used for digital documentation after excavation
- LOut6: Present three types of digital documents produced by archaeological documentation after excavation
- LOut8: Review four advantages of digital over non-digital archaeological documentation
- LOut11: Apply a data collection form to document two different categories of excavation finds
- LOut14: Create a data collection form suitable for data collection after excavation

3.3.3 Learning techniques

The learning techniques include:

- studying of learning material (chapters in the handbook)
- watching the relevant presentations of Unit M2.3
- reading the suggested optional bibliography
- watching the suggested optional videos
- visit the suggested websites

3.3.4 Further reading and watching

1. H. Burke and C. Smith, *The Archaeologist's Field Handbook*. Sydney/Melbourne/Auckland/London: Allen & Unwin, 2004. https://www.researchgate.net/publication/282694403_The_Archaeologist%27s_Field_Handbook

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2. D.M. Corredor and J. Molina Vidal, Archaeological Quantification of Pottery: The Rims Count Adjusted using the Modulus of Rupture (MR), *Archaeometry* 2015, 58:2, 333-346. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/arcm.12171
3. P.L. Drewett, *Field Archaeology: An Introduction*, London: UCL Press, 1999.
4. H. Eiteljorg, *Archaeological Computing. With GIS Chapter by W. Fredrick Limp*. The Center for the Study of Architecture, Bryn Mawr, PA, Second Edition, 2008.
5. S. Graham, N. Gupta, J. Smith, A. Angourakis, A. Reinhard, K. Ellenberger, Z. Batist, J. Rivard, B. Marwick, M. Carter, B. Compton, R. Blades, C. Wood, and G. Nobles, *The Open Digital Archaeology Textbook*, 2019. https://o-date.github.io/draft/book/index.html.
6. J. Grant, S. Gorin and N. Fleming *The Archaeology Coursebook. An introduction to themes, sites, methods and skills*, Third edition. London and New York: Routledge, 2008.
7. J.J.L. Kimball, *3D Delineation: A modernisation of drawing methodology for field archaeology*. Archaeopress, Oxford, 2016.
8. S. Verdan, Pottery quantification: some guidelines, in S. Verdan et al. (ed.), *Early Iron Age Pottery: a Quantitative Approach, Proceedings of the International Round Table*, BAR IS 2254, Oxford, 2011, 165-171. Available at:

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3.4 Post-excavation analysis of digital archaeological data (Module 2, Unit 4)

(Yiannis Papadatos, Alexandra Katevaini)

This unit focuses on post-excavation analysis and interpretation of the archaeological data collected in situ and after the excavation, with the use of digital tools. Following this session, the learner will understand the importance of digital tools for analyzing and managing data, extracting information and interpreting the archaeological data.

The unit covers the following topics:

- Create summary reports with graphs and tables
- Export data in various forms for media and analysis
- Transferring the digital archaeological data into open source GIS (QGIS)
- Processing and analysis of digital archaeological data in GIS environment

The first learning object (2.1.4.a) is about how to visualize, filter, process and analyze digital data collected in the excavation field and the laboratory. More specifically, it deals about how to visualize, filter, process and analyze collected data in the KoBoToolbox dashboard and in free open-source spreadsheet applications. It includes the creation of summary reports, graphs and tables, the visualization of collected data, and the exportation of data in various file formats for

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processing, particularly in free open source spreadsheet applications (e.g. LibreOffice Calc).

The second learning object (2.1.4.b) is on how to transfer digital archaeological data from a relational database to an open source GIS application, namely QGIS, and the various ways to visualize digital archaeological data in this GIS platform.

The third learning object (2.1.4.c) introduces learners to the concept of GIS and the importance of the analysis of spatial archaeological data with the use of GIS applications, namely QGIS.

The last learning object (2.1.4.d) shows how to process and analyze spatial archaeological data in open source GIS software, namely QGIS. The data which is used, are those collected with the learning objects M2.2.e and M2.3.d.

3.4.1 Learning object

The main learning object used of Unit M2.4 are:

- 2.1.4.a: The relevant chapters in the teaching handbook
- 2.1.4.b: The relevant video presentations, directly related to the above chapters
- 2.1.4.c: Optional bibliography for further reading
- 2.1.4.d: Visit to specific websites for further information and for downloading open-access free software

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3.4.2 Learning outcomes

Upon completion of this course, the learners will be able to:

- LOut12: Analyze the spatial archaeological data of two different excavation contexts
- LOut15: Summarize the reports of two different excavation contexts
- LOut17: Compare the spatial archaeological data of two different excavation contexts

3.4.3 Learning techniques

The learning techniques include:

- studying of learning material (chapters in the handbook)
- watching the relevant presentations of Unit M2.4
- reading the suggested optional bibliography
- visit the suggested websites

3.4.4 Further reading and watching

1. J. Huggett, Looking at intra-site GIS, in K. Lockyear, T. Sly and V. Mihailescu-Birliba (eds.) *CAA 96: Computer Applications and Quantitative Methods in Archaeology*, 2000, pp 117-122.
2. M. Katsianis, S. Tsipidis, K. Kotsakis, and A. Kousoulakou, A 3D digital workflow for archaeological intra-site research using GIS. *Journal of Archaeological Science*, 2008, 35(3), pp. 655-667.
3. G. Lock, *Using computers in archaeology: towards virtual pasts*. Routledge, 2003.

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4. Digital preservation and presentation of cultural heritage monuments and artifacts (Module 3)

(Francesca Sogliani, Dimitris Roubis, Mariasilvia Vullo)

The module 3 *Digital preservation and presentation of cultural heritage monuments and artifacts* focuses on those techniques, which effectively enable archaeologists to produce, manage and visualize digital data for the preservation and presentation of cultural heritage, from the largest scale of entire buildings or archaeological sites and their surrounding landscape, down to the smallest scale of artifacts and ecofacts. In this regard, trainees will be able to:

- Produce and store digital documentation for the formal presentation of archaeological heritage (CAD software, digital tools for artifacts drawings, DB, GIS, GPS)
- Practice a powerful combination of photogrammetric and measurement techniques in connection with 3D imaging and drone
- Select effective case studies for virtual restoration and conservation of ornamental surfaces of monuments and artifacts (3D restoration and 3D printing) and design a project of virtual restoration with practical application
- Be familiar with VR and immersive VR, AR Augmented Reality

Module 3 is divided into 4 thematic blocks (units) – *Digital documentation for the formal presentation of post-excavation*

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archaeological heritage; Photogrammetric and measurement techniques in connection with 3D imaging and drone of post-excavation archaeological heritage; Virtual restoration and conservation of ornamental surfaces of monuments and artifacts (3D restoration and 3D printing) and VR and immersive VR, AR Augmented Reality.

4.1 *Digital documentation for the formal presentation of post-excavation archaeological heritage* (Module 3, Unit 1)

(Francesca Sogliani, Dimitris Roubis, Mariasilvia Vullo, Luisa Aino)

The unit covers the following topics:

- Data processing (DB and archives, schedules, photos, metadata)
- Digital tools for artifacts drawings
- GIS Platform
- GPS Data georeferencing

The first learning object (3.1.1a) introduces learners different types of data processing, the hierarchical structure of DB and archives, vocabulary and specific dictionaries for DB, integration system of photos and metadata. In this learning object there will be a definition of DB and archives aimed to process post-excavation procedures and

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how to implement archaeological data in respect of the hierarchical structure of data.
Explanation of vocabulary and specific dictionaries for DB are integral to this learning object as the integration system of photos and metadata. Application of how to fill DB and manage different types of data is part of the course.

Next learning object (3.1.1.b) introduces learners' digital tools and methodologies for artifacts drawings (mobile objects, structures and contexts). In this learning object there will be explained how to create vectorial representations, usable within CAD and others drawing software, starting from a photogrammetric survey. Drawing the finds represents a fundamental passage of the archaeological documentation, also during the subsequent data analysis. The three-dimensional modeling, integrating in the normal practice of drawing, allows to understand the main morphological and metric characteristics, facilitating typological seriation, the establishment of comparisons and the consequent chronological classification; finally it carry out a process of restitution and reconstruction of the artifacts starting from the two-dimensional documentation.

The third learning object (3.1.1c) focus on how to implement archaeological records on GIS platform for spatial analysis and interactive maps for preservation and presentation of cultural heritage monuments and artifacts. In this learning object there will be explained how to create a story map in a webgis where photos,

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videos, data, texts to comment on geographical and thematic maps can be inserted. Make presentations based on all the supports processed (texts, images, videos, audio) and use cartographic representations in an interactive way are part of this course.

The fourth learning object (3.1.1d) focus data implementation and GPS data georeferencing on GIS Platform.

4.1.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 3.1.1.a: Study of learning material (handbook)
- 3.1.1.b: a presentation on archaeological data processing
- 3.1.1.c: a video tutorial on digital tools for artifacts drawings
- 3.1.1.d: a presentation and video tutorial on how to use CAD software for artifacts (mobile finds and structures)
- 3.1.1.e: a presentation on data implementation and GPS data georeferencing on GIS Platform

4.1.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut1: Recognize three data processing methods
- Lout13: Apply two data processing methods
- Lout14: Practice digital tools for artifacts drawings

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- Lout26: Evaluate two digital tools for artifacts drawings
- Lout2: State CAD software for artifacts
- Lout15: Operate CAD software for artifacts
- Lout24: Collect five data implementation and GPS data georeferencing on GIS Platform

4.1.3 Learning techniques

Among the learning techniques to acquire the ability to process of data, use digital tools for artifacts drawings and use GIS Platform, GPS Data georeferencing, will include:

- study of a learning material (a handbook);
- a presentation on archaeological data processing
- video tutorial on digital tools for artifacts drawings
- a presentation and video tutorial on how to use CAD software for artifacts (mobile finds and structures)
- a presentation on data implementation and GPS data georeferencing on GIS Platform

4.1.4 Further reading and watching

M3.1.1.a Data processing (DB and archives, schedules, photos, metadata)

Article by R. Schiader, "Archaeological databases: what are they and what do they mean?" Available online at: https://proceedings.caaconference.org/files/2001/65_Schlader_CAA_2001.pdf

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Article by P. Ronzino, S. Hermon and F. Niccolucci, "A metadata schema for cultural heritage documentation", Conference Paper · January 2014. Available online at: file:///C:/Users/maliskova/Downloads/EVA2012.pdf.

Article by A. Ossa, "Basic Archaeological Database Design". Available online at: file:///C:/Users/maliskova/Downloads/Ossa_Basic_Archaeological_Database_Design.pdf

Article by Paul Miller, "The Importance of Metadata to Archaeology: One View from within the Archaeology Data Service", CCA 1997. Available online at: https://proceedings.caaconference.org/files/1997/21_Miller_CAA_1997.pdf

Article by M. Henninger, "From mud to the museum: Metadata challenges in archaeology", Journal of Information Science 44(5):658-670. Available online at: https://www.researchgate.net/publication/321139222_From_mud_to_the_museum_Metadata_challenges_in_archaeology

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M3.1.1.b Digital tools for artifacts drawings

Article "Using AutoCAD to Digitise Archaeological Plans". Available online: at: http://www.surveyingarchaeology.co.uk/Manuals/UsingAutoCADtoDigitiseArchaeologicalPlans.pdf

Article by S. Dobson, R. Lancia and K., Niven, "Introduction to CAD", 2011. Available online at: https://guides.archaeologydataservice.ac.uk/g2gp/Cad_1-1

Article by I. Badiu, Z. Buna, R. Comes. "Automatic generation of ancient pottery profiles using cad software", Computer Science, June 2015. Available online at: https://www.semanticscholar.org/paper/AUTOMATIC-GENERATION-OF-ANCIENT-POTTERY-PROFILES-Badiu-Buna/3c2a7ffd45fe48a686fc88db890d5391e5f869de

Article "Teaching-Through-Collections-Sketch-An-Artifact". Available online at: https://www.uaf.edu/museum/education/educators/teaching-through-collecti/pdfs/Teaching-Through-Collections-Sketch-An-Artifact.pdf

Article by Gilboa et al, "Computer-based automatic recording and illustration of complex archaeological artifacts", Journal of

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Archaeological Science 40(2):1329-1339, DOI:10.1016/j.jas.2012.09.018

Article by G. Agre, "A Software System for Classification of Archaeological Artefacts Represented by 2D Plans", Cybernetics and Information Technologies Volume 13(Issue 2), 82-95 pp. May 2013, DOI:10.2478/cait-2013-0017

Article by L. Collett, "Introduction to drawing archaeological pottery", 2012. Available online at: https://nautarch.tamu.edu/class/anth489/501/Analyticalmethods/Readings/Collett%20(2012)%20Introduction%20to%20drawing%20archaeological%20pottery.pdf

M3.1.1.c GIS Platform

Chapter 1 in a book by D. Wheatley and M. Gillings, "Spatial Technology and Archaeology. The Archaeological Applications of GIS". 2002.

Article by E. Valente and M. Cozzolino, "GIS mapping of the archaeological sites in the Molise region (Italy)", Archeologia e Calcolatori 30, 2019, 367-385.

Article by S. Mantellini, "GIS and remote sensing for a preliminary assessment of the archaeological landscape in the Eblaite chora (Syria)", Conference: Documentare l'archeologia 4.0: Strumenti e

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metodi per la costruzione di banche dati territorialiAt: Bologna, May 2014. Available online at: https://www.researchgate.net/publication/296678556_GIS_and_remote_sensing_for_a_preliminary_assessment_of_the_archaeological_landscape_in_the_Eblaite_chora_Syria

Article by J. Barcelo and Maria Pallarés, "A critique of G.I.S. in archaeology. From visual seduction to spatial analysis", Archeologia e Calcolatori 7, 1996, 313-326. Available online at: https://www.researchgate.net/publication/29686328_A_critique_of_GIS_in_archaeology_From_visual_seduction_to_spatial_analysis

M3.1.1.d GPS Data georeferencing

Article by A. Scianna, "Multimedia guide in archaeological sites by GIS-GPS techniques, pocketPCs and pocket GPSs". 2004. Available online at: https://www.academia.edu/18041734/Multimedia_guide_in_archaeological_sites_by_GIS_GPS_techniques_pocketPCs_and_pocket_GPSs

"A Short Guide to GPS", Available online at: http://www.bajr.org/BAJRGuides/9.%20A%20Short%20Guide%20to%20GPS/AShortGuidetoGPS.pdf

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4.2 *Photogrammetric and measurement techniques in connection with 3D imaging and drone of post-excavation archaeological heritage* (Module 3, Unit 2)

(Francesca Sogliani, Dimitris Roubis, Mariasilvia Vullo, Luisa Aino)

The unit covers the following topics:

- photogrammetry and measurement techniques
- drone
- 3D imaging

The first learning object (3.1.2a) introduces learners principles base of photogrammetry and measurement techniques. In this learning object, there will be a definition of Photogrammetry and measurement methodologies and a demonstration of techniques application aimed to process post-excavation archaeological data. Learning and combining in practice the techniques of Photogrammetry and measurement for knowledge, conservation, and highlighting of archaeological heritage is part of this learning object.

Next learning object (3.1.2.b) introduces learners to use drone-acquired data to produce 3D digital documentation and maps for conservation and presentation of archaeological heritage. In this learning object there will be explained how to implement and to process acquired drone archaeological data, starting from specific

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software. The three-dimensional modeling, allows carrying out spatial analysis of site and artifacts through landscape digital maps and restitution and reconstruction of archaeological monuments and contexts.

The third learning object (3.1.2c) introduces learners how to realize 3D images of archaeological artifacts and contexts and how to use 3D reproduction focusing the presentation of archaeological items. In this learning object there will be explained the basic skills needed to create a three-dimensional survey starting from digital photographs and videos, and how to prepare the 3D model for sharing on the web and for 3D printing.

4.2.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 3.1.2a: Study of learning material (handbook)
- 3.1.2.b: watching a presentation on photogrammetry and measurement techniques
- 3.1.2.c: watching a presentation and video tutorial on drone post-excavation data processing
- 3.1.2.d: watching a presentation and video tutorial on 3D imaging procedures (case studies applications)

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4.2.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut3: Reproduce three photogrammetry and measurement techniques methods
- LOut16: Apply two photogrammetry and measurement techniques methods
- LOut4: State drone post-excavation data processing
- LOut17: Practice two drone post-excavation data processing
- LOut18: Produce two 3D imaging procedures
- LOut25: Develop two 3D imaging procedures

4.2.3 Learning techniques

Among the learning techniques how to understand the principles base of photogrammetry and measurement techniques, use drone acquired data to produce 3D digital documentation and maps and how to realize 3D images of archaeological artifacts and contexts and how to use 3D reproduction, will include:

- study of a learning material (a handbook)
- a presentation on photogrammetry and measurement techniques
- a presentation and video tutorial on drone post-excavation data processing

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- a presentation and video tutorial on 3D imaging procedures (case studies applications)

4.2.4 Further reading and watching

M3.1.2.a Photogrammetry and measurement techniques

Article by F. Neitzel and J. Klonowski, "Mobile 3D mapping with a low-cost UAV system?", ISPRS - International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences XXXVIII-1/C22(1):39-44, 2011, DOI:10.5194/isprsarchives-XXXVIII-1-C22-39-2011

Article by F. Nex and F. Remondino, "UAV for 3D mapping applications: A review", Applied Geomatics 6(1), 2014 DOI:10.1007/s12518-013-0120-x

Article by N. Haala, M. Cramer, F. Weimer and M. Trittler, "Performance test on UAV-based photogrammetric data collection", ISPRS - International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences XXXVIII-1/C22(1), 2012 DOI:10.5194/isprsarchives-XXXVIII-1-C22-7-2011

Publication by H. Eisenbeiss, "A mini unmanned aerial vehicle (uav): system overview and image acquisition", 2009. Available online at: https://www.researchgate.net/publication/228788846_A_mini_unmanned_aerial_vehicle_UAV_system_overview_and_image_acquisition

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M3.1.2.b Dron

Article by S. Campana, "Drones in Archaeology. State-of-the-art and Future Perspectives", Archaeol. Prospect. 24, 275–296 2017. Available online at:
https://www.researchgate.net/publication/313799693_Drones_in_Archaeology_State-of-the-art_and_Future_Perspectives_Drones_in_Archaeology

M3.1.3.c 3D imaging

Chapter 1 in a book Scientific Computing and Cultural Heritage (pp.31-39), by Ch. Hörr and G. Brunnett, "Boon and Bane of High Resolutions in 3D Cultural Heritage Documentation", 2013
DOI:10.1007/978-3-642-28021-4_4

Article by M. Caprioli and A. Scognamiglio, "Low cost methodology for 3D modeling and metric description in architectural heritage".
Article by JeroenDe Reu et al, "Towards a three-dimensional cost-effective registration of the archaeological heritage", Journal of Archaeological Science Volume 40, Issue 2, February 2013, 1108-1121 pp. https://doi.org/10.1016/j.jas.2012.08.040

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4.3 *Virtual restoration and conservation of ornamental surfaces of monuments and artifacts (3D restoration and 3D printing)* (Module 3, Unit 3)

(Francesca Sogliani, Dimitris Roubis, Mariasilvia Vullo, Luisa Aino)

The unit covers the following topics:

- Methodology and software for restoration of ornamental surfaces of monuments and artifacts, like frescoes, architectural sculptures, mosaics, ceramic, glass and metal objects and 3D restoration and 3D printing
- 3D restoration and 3D printing for archaeological artifacts (ceramic, glass)

The first learning object (3.1.3a) introduces learners the base methodology for digital restoration and the software used for that. In this learning object there will be a definition of methodologies use to realize digital restoration of artifacts and monuments and a demonstration of software dedicated to digital processes for restoration and conservation of material heritage.
Learning, analyzing and selecting methodologies and software for conservation, preservation and highlighting of archaeological heritage is part of this learning object.

Next learning object (3.1.3.b) introduces learners' the base methodologies and software for 3D restoration, the base procedures

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to realize 3D images of archaeological artifacts and 3D printings and how to use 3D reproduction focusing the presentation of archaeological items. In this learning object there will be a definition of methodologies used to realize 3D restoration of archaeological artifacts and a demonstration of software and procedures dedicated to 3D printing. It will be also explained the basic skills needed to create a three-dimensional survey starting from digital photographs and videos, and how to prepare the 3D model for sharing on the web and for 3D printing.

4.3.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 3.3.1.a: Study of learning material (handbook)
- 3.3.1.b watching a presentation and video tutorial on Digital restoration and conservation (case studies applications)
- 3.3.1.c: watching a presentation and video tutorial on3D restoration (case studies applications)
- 3.3.1.d: watching a presentation and video tutorial on 3D printing (case studies applications)

4.3.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut6: List three methodologies of digital restoration

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- LOut7: Identify two softwares aimed at digital restoration
- LOut9: Explain three case studies of Virtual restoration and conservation methods
- LOut23: Categorize three case studies of Virtual restoration and conservation methods
- LOut10: Describe two 3D restoration methodologies
- LOut21: Compare three 3D restoration case studies
- LOut11: Discuss two 3D printing procedures
- LOut28: Assess two 3D printing case studies

4.3.3 Learning techniques

Among the learning techniques to understand the base methodology for digital restoration and the software and the principles of 3D restoration and 3D printing for archaeological artifacts, will include:

- Study of learning material (handbook)
- a presentation and video tutorial on Virtual restoration and conservation (case studies applications)
- a presentation and video tutorial on3D restoration (case studies applications)
- a presentation and video tutorial on 3D printing (case studies applications)

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4.3.4 Further reading and watching

M3.3.1. Methodology and software for restoration of ornamental surfaces of monuments and artifacts and ● 3D restoration and 3D printing

Publication by F. Silvestrelli and I. E. M. Edlund-Berry, "The Chora of Metaponto 6. A Greek Settlement at Sant´Angelo Venice". 2016.

Article by C. Lorenzo and L. Massimo, "The Nymphaeum of the Tritons at Hierapolis of Phryga (Turkey) from excavations to 3D-virtual reconstruction: An example of integrated methods in the study of Ancient architecture. 5th International Congress.

Article by M. Higueras et al., "Digital 3D modeling using photogrammetry and 3D printing applied to the restoration of a Hispano-Roman architectural ornament", Digital Applications in Archaeology and Cultural Heritage Volume 20, March 2021, e00179. Available online at: https://www.sciencedirect.com/science/article/abs/pii/S2212054821000084?via%3Dihub

Article by C. Ballett et al., "3D printing: State of the art and future perspectives", Journal of Cultural Heritage Volume 26, July–August 2017, Pages 172-182. Available online at: https://www.sciencedirect.com/science/article/abs/pii/S1296207416301698?via%3Dihub

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Article by Ch. Qiao, "In situ virtual restoration of artifacts by imaging technology", Heritage Science volume 8, Article number: 110 (2020). Available online at: https://heritagesciencejournal.springeropen.com/articles/10.1186/s40494-020-00458-0

Article by P. M. Lerones et al., "Using 3D digital models for the virtual restoration of polychrome in interesting cultural sites", Journal of Cultural Heritage Volume 15, Issue 2, March–April 2014, Pages 196-198, https://doi.org/10.1016/j.culher.2013.03.009

Article by G. Florin et al., "Virtual restoration of deteriorated religious heritage objects using augmented reality technologies", European Journal of Science and Theology, 2013. Available online at: https://www.researchgate.net/publication/259477553_Virtual_restoration_of_deteriorated_religious_heritage_objects_using_augmented_reality_technologies

Article by D. G. Aliaga et al., "A Virtual Restoration Stage for Real-World Objects", ACM Transactions on GraphicsVolume 27Issue 5December 2008 Article No.: 149pp 1–10 https://doi.org/10.1145/1409060.1409102

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4.4 *VR and immersive VR, AR Augmented Reality* (Module 4, Unit 4)

(Francesca Sogliani, Dimitris Roubis, Mariasilvia Vullo, Luisa Aino)

The unit covers the following topics:

- Methodology and software for Virtual reality and immersive Virtual reality for preservation and presentation of artifacts, monuments, archaeological contexts and landscapes. Methodology and software for Augmented reality for preservation and presentation of artifacts, monuments, archaeological contexts and landscapes

The first learning object (3.1.4a) introduces learners the base methodology and the software used for VR and immersive VR and how to use them through a choice of case-studies. In this learning object there will be a definition of methodologies use to realize virtual and immersive virtual reality of archaeological contexts and monuments and a demonstration of software dedicated to digital processes presentation and enjoyment of archaeological heritage. Learning, analyzing and selecting VR methodologies and software for highlighting of archaeological heritage is part of this learning object.

Next learning object (3.1.4.b) introduces learners the base methodology and the software used for Augmented reality and how to use them through a choice of case-studies. In this learning object there will be a definition of methodologies use to realize augmented

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reality of archaeological contexts and monuments and a demonstration of software dedicated to digital processes presentation and enjoyment of archaeological heritage. Learning, analyzing and selecting AR methodologies and software for highlighting of archaeological heritage is part of this learning object.

4.4.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 3.4.1.a: study of a learning material (a handbook)
- 3.4.1.b: presentation and video tutorial on Virtual reality and immersive Virtual reality (case studies applications)
- 3.4.1.c: presentation and video tutorial on Augmented reality case studies

4.4.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut6: multiple choise questions
- LOut7: multiple choise questions
- LOut8: multiple choise questions
- LOut20: checkbox
- LOut27: checkbox
- LOut5: multiple choise questions
- LOut19: checkbox
- LOut 22: multiple choise questions

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4.4.3 Learning techniques

Among the learning techniques to understand learners the base methodology and the software used for VR and the base methodology and the software used for Augmented reality and how to use them, will include:

- Study of learning material (handbook)
- a presentation and video tutorial on Virtual restoration and conservation (case studies applications)
- a presentation and video tutorial on3D restoration (case studies applications)
- a presentation and video tutorial on 3D printing (case studies applications)

4.4.4 Further reading and watching

M3.1.4.a Virtual and immersive virtual reality

Article by J. C. G. V. Survey et al., "Using Augmented Reality to Improve Learning Motivation in Cultural Heritage Studie", Applied Sciences, 10(3):897, 2020. DOI:10.3390/app10030897

Article by J. A. Tenedório, "Cultural Heritage 3D Modelling and visualisation within an Augmented Reality Environment, based on Geographic Information Technologies and mobile platforms", February 2017, Architecture 11(33):117-136. DOI:10.5821/ace.11.33.4686

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Article by P. Cipresso, "The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature", November 2018Frontiers in Psychology 9:2086. DOI:10.3389/fpsyg.2018.02086

M3.1.4.b Augmented reality

Article by J. C. G. Vargas, "Survey: Using Augmented Reality to Improve Learning Motivation in Cultural Heritage Studies", January 2020, Applied Sciences 10(3):897. DOI:10.3390/app10030897

Article by J. A. Tenedório, "Cultural Heritage 3D Modelling and visualisation within an Augmented Reality Environment, based on Geographic Information Technologies and mobile platforms", February 2017, Architecture 11(33):117-136. DOI:10.5821/ace.11.33.4686

Article by P. Cipresso, "The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature", November 2018Frontiers in Psychology 9:2086. DOI:10.3389/fpsyg.2018.02086

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5. Open-Air Museums and Experimental Archaeology (Module 4)

(Panagiota Polymeropoulou)

This module will introduce the students of Archaeology to the value of archaeological open-air museums, their management and their visitors. Also, learners will understand how the practice of experimental archaeology is strongly connected growing craft experience. Through this module, learners will comprehend how to acquire 21st century skills related to audience engagement and storytelling techniques. Effective interpretation will allow them to make each visitor personally connect with a resource or place and to care about the sites. The public archaeology will help young researchers to better understand archaeological processes and allow audience to interact with archaeological knowledge. In this regard, trainees will be able to:

- Presentation of archaeological findings and contexts in different target groups
- Interpretation of archaeological artifacts and remains through guided tours, workshops, open days and semi-formal School programs.
- Application of Museum Practice in Archaeological Open-Air museums

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Module 3 is divided into 4 thematic blocks (units) – *What is an Open – air Museum?; The meaning and scope of Experimental Archaeology; Live interpretation in AOMs; How to best manage an open – air museum?; Low-tech and High-tech Approaches in Archaeological Open-Air Museums*

5.1 *What is an Open – air Museum?* (Module 4, Unit 1)

The unit covers the following topics:

- term of open – air museum or site museum
- first open-air museum of Skansen
- open-air museums in the world
- term Public archaeology

The first learning object (4.1.1a) introduces the learners to the meaning and the term of open – air museum or site museum. The video informs the learners on the term based on the EXARC.

Next learning object (4.1.1.b) introduces learners' how and for what reason began the Public Archaeology? Through this presentation, learners will know more about the term and the main objectives of Public Archaeology. The scope of public archaeology comprises of many facets. The design, goals, communities and methods used in projects can vary greatly, but there are general aspects that are

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common to all. In this video, learners will learn more about how the public archeology involves the community.

5.1.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 4.1.1.a: : a presentation on open-air muzeum
- 4.1.1.b: a presentation on public archaeology

5.1.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut1: Outline the history of archaeological open – air museums
- LOut2: Define the meaning of public archaeology
- LOut3: List two paradigms of open – air museum
- LOut4: Recognize the importance of dissemination of archaeological results to the public
- LOut5: Indicate at least two ethical considerations in public archaeology
- LOut7: Select at least two examples of open – air museum practices in engaging diverse audiences
- LOut8: Explain the meaning of open – air museums according to EXARC

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5.1.3 Learning techniques

Among the learning techniques to understand a term open-air museum and public archaeology, will include:

- a presentation on open-air museum
- a presentation on public archaeology

5.1.4 Further reading and watching

M4.1.1.a Open-air muzem

Document on CULTURAL RIGHTS Fribourg Declaration. Available online at:
http://hrlibrary.umn.edu/instree/Fribourg%20Declaration.pdf

Article by R. Tichý, ""Days of Living Archaeology" at the Prehistoric Archaeopark Vsestary, Czech Republic", EXARC Journal Issue 2017/2. Available online at: https://exarc.net/issue-2017-2/aoam/days-living-archaeology-prehistoric-archaeopark-vsestary-czech-republic

M4.1.1.b Public archaelogy

Article by Lorna-Jane Richardson, "Ethical Challenges in Digital Public Archaeology", Journal of Computer Applications in Archaeology, 1(1), pp.64–73. DOI: http://doi.org/10.5334/jcaa.13

Article by A. Matsuda, "The Concept of 'the Public' and the Aims of Public Archaeology", Papers from the Institute of Archaeology 15, 2004. DOI:10.5334/pia.224

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Article by S. Lekakis, "FORUM: Chatting about the future of public archaeology ARCHAEOLOGY FOR THE PUBLIC IN GREECE MINUS/PLUS TEN", AP: Online Journal in Public Archaeology Volume 10 - 2020 p. 105-108. DOI:10.23914/ap.v10i0.303

5.2 *The meaning and scope of Experimental Archaeology* (Module 4, Unit 2)

The unit covers the following topics:

- term Experimental Archaeology

The first learning object (4.1.2a) introduces the students to the term Experimental Archaeology so to be able to get to know best practices and methods of applied experimental archaeology in Europe and US.

Next learning object (4.1.2.b) throught publication by Lara Comis, is based on a presentation given at the 8th liveArch Conference themed "The dialogue of knowledge" held at the Matrica Múzeum és Régészeti Park in Hungary (October 7-11, 2009). Th is article has been framed within the structure of the dialogue between experimental archaeology and Archaeological Open Air Museums.

5.2.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

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- 4.1.2.a: : a presentation on experimental archaeology
- 4.1.2.b: a narrative text (theory)

5.2.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut6: Identify at least one international network of professionals involved in archaeological open-air museums and experimental archaeology.
- LOut15: Illustrate one example of experimental archaeology.

5.2.3 Learning techniques

Among the learning techniques to understand a term open-air museum and public archaeology, will include:

- a presentation on experimental archaeology
- a narrative text (theory)

5.2.4 Further reading and watching

M4.1.2. Experimental archaeology

Chapter in a book Experiments Past, Histories of Experimental Archaeology, by S. Bakas, "The Developmental Steps of Experimental Archaeology in Greece Through Key Historical Replicative Experiments and Reconstructions". 2014. Available online at: https://www.academia.edu/9300867/The_Developmental_Steps_of_Experimental_Archaeology_in_Greece_Through_Key_Historical_Replicative_Experiments_and_Reconstructions

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Article by L. COMIS, "Experimental Archaeology: Methodology and new perspectives in Archaeological Open Air Museums".
Article by Yvonne M. J. Lammers-Keijsers, "Scientific experiments: a possibility? Presenting a general cyclical script for experiments in archaeology". Available online at: https://exarc.net/sites/default/files/exarc-eurorea_2_2005-scientific_experiments_a_possibility.pdf
https://www.youtube.com/watch?v=ZQh551X-ACU

Article by H. Malta, "Experimental Archaeology", December 2013. Available online at: https://www.researchgate.net/publication/275352957_Experimental_Archaeology

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5.3 Live interpretation in AOMs (Module 4, Unit 3)

The unit covers the following topics:

- Live interpretation in AOMs

The first learning object (4.1.3a) explains to the learners what is live interpretation, what to do and what to avoid in order to engage diverse audiences and thus, to raise public awareness on a cultural site or cultural issue.

5.3.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 4.1.3.a: a presentation on live interpretation in AOMs

5.3.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut9: Recognize that public can contribute to know more on cultural heritage;
- LOut12: Examine at least two do's and don'ts in live interpretation.

5.3.3 Learning techniques

Among the learning techniques to understand a term open-air museum and public archaeology, will include:

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- a presentation on live interpretation in AOMs

5.3.4 Further reading and watching

M4.1.3. Experimental archaeology

Artocle by M. Danks et al., "Interactive Storytelling and Gaming Environments for Museums: The Interactive Storytelling Exhibition Project". Available online at: https://research.brighton.ac.uk/en/publications/interactive-storytelling-and-gaming-environments-for-museums-the-

Katifori, Akrivi, Restrepo Lopez, Klaoudia Marsella, Petousi, Dimitra, Karvounis, Manos, Kourtis, Vassilis, Roussou, Maria and Ioannidis, Yannis. "Approaching "Dark Heritage" Through Essential Questions: An Interactive Digital Storytelling Museum Experience." MW19: MW 2019 . Published January 13, 2019. Consulted March 20, 2019. Link: https://mw19.mwconf.org/paper/approaching-dark-heritage-through-essential-questions-an-interactive-digital-storytelling-experience-for-the-university-of-athens-criminology-museum/

A book by F. Tilden, "Interpreting Our Heritage". 2009.
Manual by G. Tilkin, "Professional Development in Heritage Interpretation"

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5.4 How to best manage an open – air museum? (Module 4, Unit 4)

The unit covers the following topics:

- methods to properly manage an open – air museum
- importance of actualization and preservation of reconstructions

The first learning object (4.1.4.a) guides the students on the best methods to properly manage an open – air museum.

Next learning object (4.1.4.b) is a guideline by McGhie, H.A. (2019). Museums and the Sustainable Development Goals: a how-to guide for museums, galleries, the cultural sector and their partners. Curating Tomorrow, UK.

5.4.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 4.1.4.a: a presentation on methods how to manage an opne.air museum
- 4.1.4.b: a guideline

5.4.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut10: Indicate the classical trinity in cultural heritage

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management

- LOut11: Recognize at least three Sustainable Development Goals for Museums
- LOut14: Identify at least one best practice for managing an open – air museum

5.4.3 Learning techniques

Among the learning techniques to understand a term open-air museum and public archaeology, will include:

- a presentation on methods how to manage an opne.air museum
- a guideline

5.4.4 Further reading and watching

M4.1.4.a Methods how to manage an open-air museum

Culture in the sustainable development goals: a guide for local action. 2018.

An article by T. Pencarelli et al., "The sustainable management of museums: An Italian perspective", 2016, Tourism and Hospitality Management 22(1):29-46 DOI:10.20867/thm.22.1.6

A handbook by P. J. Boylan, "Running a Museum: A Practical Handbook". 2004.

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An article by M. Plaček, M. J. Půček and V. Šilhánková, "New trends in the strategic management of museums in the Czech Republic", MUSEUM MANAGEMENT AND CURATORSHIP, 2017. To link to this article: http://dx.doi.org/10.1080/09647775.2017.1347808

A book by Cuseum "The Ultimate Guide to Surviving and Thriving as a Cultural Organization in the 21st Century", 2020.
Opening up the Museum: Nina Simon @ TEDxSantaCruz : https://www.youtube.com/watch?v=aIcwIH1vZ9w

NEMO Webinar | Henry McGhie | Using the Sustainable Development Goals in Museums:
https://www.youtube.com/watch?v=kXUGPGkyUUY

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5.5 Low-tech and High-tech Approaches in Archaeological Open-Air Museums (Module 4, Unit 5)

The unit covers the following topics:

- Digital technologies in museums: New routes to engagement and participation.
- Engaging visitors of archaeological sites through "emotive" storytelling experiences: a pilot at the ancient agora of Athens.

The first learning object (4.1.5a) focus on a multimodal semiotic approach, which is applied in this selected book chapter to three examples in order to illustrate how the use of digital technology in museums and galleries can re-mediated the visitor experience. Source: Jewitt, C. 2014. Digital technologies in museums: New routes to engagement and participation in Designs for Learning, Volume 6 / Number 1–2 DOI: 10.2478/dfl-2014-0005

Next learning object (4.1.5.a) focus on an use of interactive storytelling by museums and heritage sites lends to the creation of experiences that support visitors in engaging emotionally with the objects on display. In this paper, is described the creation of a prototype mobile storytelling experience that attempts to explore a more emotive kind of storytelling in cultural contexts. The prototype

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was evaluated in a preliminary study that took place at the archaeological site of the Ancient Agora of Athens.

5.5.1 Learning objects

Core learning objects are combination of various forms of education (e.g., video, presentation, etc.). For each unit they are defined as:

- 4.1.5.a: a narrative Text (theory)
- 4.1.5.b: a narrative Text (theory)

5.5.2 Learning outcomes, expected skills and knowledge

Upon completion of this course, the learners will be able to:

- LOut16: Identify at least one example of storytelling in archeological site
- LOut17: Investigate at least two examples of applied technological approaches in open – air museums

5.5.3 Learning techniques

Among the learning techniques to look into a digital technologies in museums, will include:

- a narrative text (theory)

5.5.4 Further reading and watching

M4.1.5. Low-tech and High-tech Approaches in Archaeological Open-Air Museums

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New European Bauhaus - an interview with Merete Sanderhoff (blog post): https://pro.europeana.eu/post/new-european-bauhaus-an-interview-with-merete-sanderhoff

How will museums of the future look? | Sarah Kenderdine | TEDxGateway 2013 (YouTube): https://www.youtube.com/watch?v=VXhtwFCA_Kc

An article by D. Cunliffe, "Usability Evaluation for Museum Web Sites", ISSN: 0964-7775 (Print) 1872-9185 (Online) Journal homepage: https://www.tandfonline.com/loi/rmmc20

Jasper Visser / Jim Richardson DIGITAL ENGAGEMENT IN CULTURE, HERITAGE AND THE ARTS

An article J. Visser and J. Richardson, "DIGITAL ENGAGEMENT IN CULTURE, HERITAGE AND THE ARTS", Available online at: https://www.academia.edu/22814014/DIGITAL_ENGAGEMENT_IN_CULTURE_HERITAGE_AND_THE_ARTS

An article by T. Engelke et al., "A Digital Look at Physical Museum Exhibits : Designing Personalized Stories with Handheld Augmented Reality in Museums", October 2013. Conference: Digital Heritage International CongressAt: MarseilleVolume: 2, DOI:10.1109/DigitalHeritage.2013.6744836

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