

Digital excavation and the new skills for archaeologists in the DELTA project

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Abstract – The COVID-19 pandemic disrupted education provision at an unprecedented scale. The impact of limited use of digital educational tools and skills became more apparent during the pandemic, which created serious problems in conducting face-to-face excavation training in both the classroom and on excavation sites. Within this context, the integration of these two physical spaces through the digital “space” of online training is the main objective of project DELTA “*Digital Excavation through Learning and Training in Archaeology*”, a transnational project funded in the context of Erasmus+/KA2 EU program (2019-2022) with the coordination of the Hellenic Open University (DAISSy research group) and participants the relevant departments of archaeology of National and Kapodistrian University of Athens (Greece), University of Basilicata (Matera, Italy), and Masaryk University (Brno, Czech Republic). The results of the first phase of the project included desk research aiming at recording the existing situation in the three countries concerning: the use of digital applications in archaeological excavations, courses on excavation practices, methods/techniques, and the use of digital educational tools. The survey recorded the most recent trends in the university curricula, existing digital skills and level of expertise of students - professionals, their needs and desires concerning the use of digital applications in excavation and archaeological education. The results proved to be particularly revealing, especially when comparing the situation between the three countries. DELTA project aimed to design and develop a course through which students of Archaeology were able to improve their knowledge and develop digital and 21st century skills. The online piloting allowed participating Universities to discuss the level of integration of digital applications, tools and methods in teaching and learning in Archaeology online, necessary digital skills and make suggestions for the future. Particularly within the context of the recent pandemic and the problems it created in students’ excavation training.

Key words – archaeology; EU project; digital skills; digital excavation; higher education; training;

Titel – Digitale Ausgrabung und die neuen Fertigkeiten für Archäolog:innen im DELTA-Projekt

Zusammenfassung – Die COVID-19-Pandemie hat das Bildungsangebot in einem noch nie dagewesenen Ausmaß unterbrochen. Die Auswirkungen der bis dato begrenzten Nutzung digitaler Bildungswerkzeuge und -fähigkeiten wurden während der Pandemie noch deutlicher, was u.a. zu ernsthaften Problemen bei der Durchführung von persönlichen Ausgrabungsschulungen sowohl im Unterrichtsraum als auch auf Ausgrabungsstätten führte. In diesem Zusammenhang ist die Integration dieser beiden physischen Räume durch den digitalen “Raum” der Online-Ausbildung das Hauptziel des Projekts DELTA “*Digital Excavation through Learning and Training in Archaeology*” – ein transnationales Projekt, das im Rahmen des EU-Programms Erasmus+/KA2 (2019-2022) finanziert wird. Es wird von der Hellenic Open University (Forschungsgruppe DAISSy) koordiniert, teilnehmend sind die archäologischen Abteilungen der Nationalen und Kapodistrianischen Universität Athen (Griechenland), der Universität Basilicata (Matera, Italien) und der Masaryk-Universität (Brno, Tschechische Republik). Die Ergebnisse der ersten Projektphase umfassten eine Sekundärforschung, die darauf abzielte, die bestehende Situation in den drei Ländern in Bezug auf den Einsatz digitaler Anwendungen bei archäologischen Ausgrabungen, Kursen zu Ausgrabungspraktiken, Methoden und Techniken sowie den Einsatz digitaler Bildungswerkzeuge zu erfassen. Die Umfrage erfasste die jüngsten Trends in den Lehrplänen der Universitäten, die vorhandenen digitalen Fähigkeiten und das Niveau der Fachkenntnisse von Studenten und Fachleuten sowie ihre Bedürfnisse und Wünsche in Bezug auf den Einsatz digitaler Anwendungen bei Ausgrabungen und in der archäologischen Ausbildung. Die Ergebnisse erwiesen sich als besonders aufschlussreich, insbesondere wenn man die Situation zwischen den drei Ländern vergleicht. Ziel des DELTA-Projekts war es, einen Kurs zu konzipieren und zu entwickeln, durch den Archäologiestudenten ihr Wissen verbessern und digitale Fähigkeiten und Fertigkeiten des 21. Jahrhunderts erwerben. Das Online-Pilotprojekt ermöglichte es den teilnehmenden Universitäten, den Grad der Integration digitaler Anwendungen, Werkzeuge und Methoden in die Lehre und das Online-Lernen in der Archäologie sowie die erforderlichen digitalen Fähigkeiten zu diskutieren und Vorschläge für die Zukunft zu machen. Dies gilt insbesondere vor dem Hintergrund der jüngsten Pandemie und der damit verbundenen Probleme bei der Ausbildung der Studierenden.

Schlüsselwörter – Archäologie; EU-Projekt; digitale Fähigkeiten; digitale Ausgrabung; Hochschulbildung; Ausbildung;

Introduction

The Europe 2020 strategy positions Information and Communication Technologies (ICTs) as a fundamental component in five out of the seven flagship initiatives designed to foster growth within the European Union. These initiatives encompass the “*European Platform against Poverty and Social Exclusion*”, an “*Agenda for New Skills and Jobs*”, “*Youth on The Move*”, the “*Digital Agenda for Europe*”, and

the “*Innovation Union*”. The “*Europe 2020 strategy*”, along with its associated flagships, advocates for the utilization of ICTs in addressing social inclusion. This involves harnessing the potential of ICTs to enhance opportunities for young people, improve the skills and working conditions of the workforce at large, and establish an industry capable of providing solutions for the challenges posed by health and demographic changes. Enhancing the digital literacy of the workforce stands out as

a significant challenge when it comes to the adoption of technology within cultural organizations (EUROPEAN PARLIAMENT, 2012). Digital proficiency represents one of the European Union's recognized key competences for lifelong learning, and the DELTA project is dedicated to creating a modular blended course that encompasses digital competences and 21st-century skills, aimed at elevating the proficiency of Archaeology students. DELTA, which stands for "*Digital Excavation through Learning and Training in Archaeology*", is a collaborative transnational initiative involving four partners from three European countries. These partners include the Hellenic Open University and DAISy research group (serving as the project coordinator) in Greece, the Department of History and Archaeology at the National and Kapodistrian University of Athens, the University of Basilicata's Department of Archaeology and Museology in Italy, and Masaryk University in the Czech Republic. The DELTA project has meticulously conceived and developed a course that bridges the physical realm of archaeological excavation with the digital landscape of online learning. DELTA integrates the excavation site into the educational process, employing digital tools to facilitate instruction for Archaeologists. The course is administered through a blended learning approach, utilizing an online platform, tutorial sessions, and on-site learning experiences (DELTA, 2023). The project places a strong emphasis on cultivating digital competences, enabling young and prospective archaeologists to maximize the academic returns on their education investment. This approach not only bolsters their resilience, creativity, and efficiency but also equips them with adaptable career competences.

The operational objectives of the project encompassed the following:

- a) Collaboratively designing new or enhanced training modules by universities to address the existing gaps in the curriculum for both initial and ongoing education in Archaeology, focusing on the management, documentation, and preservation of cultural heritage.
- b) Providing training for professors and students to empower them with the skills needed to effectively utilize emerging technologies.
- c) Conducting evaluations of online tools and training programs with university students to refine the products, methodology, and the capacity of trainers in delivering the training.

In the realm of culture, the evolution and progression of Information and Communication Technologies (ICT) has introduced fresh dilemmas and challenges for professionals. Both experts and

newcomers in the field now necessitate proficiency in ICT, along with the ability to exhibit creativity, adaptability, and competence in digital knowledge management (POLYMEROPOULOU ET AL., 2019).

Methodology and outcomes

Intellectual Output 1 represented the initial of the two project deliverables, focusing on the course's design, considering (a) the requisite skills for emerging archaeologists and (b) the content of training courses already offered by Archaeological departments. In light of this, prior to shaping the course, it was deemed crucial to undertake a comprehensive Desk and Field Research with the following objectives:

To document the prevailing circumstances, primarily within the three participating countries, pertaining to:

- a) Higher education programs related to excavation methods and techniques;
- b) the utilization of digital applications in archaeological excavations;
- c) the incorporation of digital educational tools in courses related to excavation practices.
- d) To investigate, evaluate, and grasp the expectations and preferences of both archaeology students and professionals regarding the utilization of digital tools and applications in:
 - (1) Archaeological excavation activities;
 - (2) courses covering excavation methodologies, practices, and techniques.

The Desk Research, conducted from January to March 2020, delved into the educational program trends of the three countries involved (Greece, Italy, and the Czech Republic) in relation to the adoption of digital tools and applications in excavation and instructional settings. The Desk Research Questionnaire collected data in three principal categories:

- Group A. General Institutional Data: Information on the University/Department, Study Programs, Teaching Approaches, Archaeology Courses, ECTS Credits, and Career Prospects.
- Group B. Courses on Field Techniques: Details concerning the course content and excavation procedures, including Duration, ECTS Credits, and the use of digital tools in excavation.
- Group C. Digital Tools and Competencies: (a) Digital tools employed in excavation practices, and (b) Digital skills imparted to students. The questionnaire was crafted in English and

filled out by the project partners using information and data gleaned from university and institution websites. A more detailed analysis of the methodology and the research analysis is presented on the long version of the report in DELTA website (DELTA, 2020).

DELTA Blended Course: the design and development approach

The new course was envisioned to encompass a comprehensive array of digital tools. DELTA's consortium culminated in the creation of a blended course titled "*Digital Excavation*," consisting of four distinct modules:

1. Digital Tools for Archaeological Practice and Excavation;
2. documentation in situ and post-excavation;
3. digital Preservation of cultural heritage monuments and artifacts;
4. Open-Air Museums and Experimental Archaeology.

The DELTA blended course, comprising a total of 200 hours and offering 8 ECTS credits, primarily catered to students pursuing Archaeology in the partner universities of the respective countries. Given the constraints posed by the COVID-19 pandemic, the face-to-face components of the course were transitioned to online sessions. It was mandatory for students from Masaryk University (Czech Republic), the University of Basilicata (Italy), and the National and Kapodistrian University of Athens (Greece), while participation from other students remained optional.

A modular training approach was deliberately chosen for the course. Within this approach, each module was composed of units, and each unit is brought to life through a series of learning activities and specific learning outcomes. The design phase, as noted in Kalou et al. (2012), stands out as the most crucial and demanding stage of course development. Introducing learning outcomes into the educational or training process marks a significant shift away from the traditional approach, which centers on teachers, and moves toward an approach that is focused on learners, as articulated in Bloom et al. (1956).

This "*learner-centered*" model adopts an "*outcome-based*" approach, concentrating on what learners will acquire, master, and be able to apply as they progress through the course. This philosophy is underscored by Bloom et al. (1964), Anderson et al. (2001), and Simpson, E. (1972). Designing learning outcomes with an emphasis on accuracy and

quality necessitates the application of specific techniques like the ABCD and SMART approaches.

Furthermore, the identification of learning outcomes is based on the Bloom taxonomy, with a particular emphasis on the Cognitive (knowledge-based) domain, as denoted in Krathwohl et al. (1973). The methodology tailored for the DELTA blended course adopts the fundamental elements of the widely recognized ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), delineated in Branch, (2009).

The ADDIE model illustrates an iterative and self-correcting training process, involving five phases of instructional design, and is instrumental in ensuring continuous assessment at every step.

Ultimately, the delivery of the DELTA course was executed through the online DELTA platform, which was designed and developed by the Hellenic Open University, as highlighted in DELTA (2019-2022).

The Association for Educational Communications and Technology (AECT) provides a definition of instructional design as "*the theory and practice of designing, developing, using, managing, and evaluating processes and resources for learning*" (REISER, 2002). The fundamental role of instructional design is to craft learning experiences that not only efficiently but effectively and engagingly facilitate the acquisition of knowledge for learners. When serving as a framework for creating learning modules, instructional design focuses on improving the process of knowledge acquisition, with the ultimate objective of captivating, motivating, and encouraging learners to attain a deeper, more substantial, and more meaningful level of understanding and knowledge.

The ADDIE model is widely regarded as one of the most crucial instructional design models because it offers a universally applicable framework for instructional design work. All instructional design models adhere to some variation of a three-step process, which includes:

- Analyzing a situation to identify the instructional need;
- generating and implementing an instructional solution;
- assessing the outcomes following the implementation of the design.

The ADDIE model functions as a general design model adopted by most instructional designers, system designers, and creators. This model serves as a blueprint for the effective development of educational materials and educational systems, and many contemporary teaching models are derivatives or adaptations of the ADDIE framework.

Utilizing a recognized instructional model like ADDIE was deemed essential, as it guided project partners throughout the design and development phases (POLYMEROPOULOU ET AL., 2023).

Module 1: Digital Tools for Archaeological Practice/Excavation

Module 1 focuses on the potential of using contemporary technology in archaeological fieldwork. Students acquire new skills with the potential to enrich their professional career in dealing with digital data, such as planning fieldwork using available digital tools and online resources, acquiring digital data from measuring devices (total station, GNSS receiver), managing spatial data and preparing digital maps, as well as applying 3D documentation methods during fieldwork. The module covered multiple phases of fieldwork and reflects the needs of professionals and stakeholders in effectively conducting an archaeological excavation in the digital era. The main advantage of the learners is training in the free and open-source software (e.g., QGIS, Meshroom), which is a cost-effective, usually cross-platform solution. Results gained through this software support cooperation between individuals and institutions. The module was divided into four units: *"Before excavation"* (unit 1), *"Geodesy"* (unit 2), *"Geographic information systems"* (unit 3) and *"3D visualisation techniques"* (unit 4).

Module 2: Documentation in situ and after excavation

The process of excavation, being both irreversible and destructive, necessitates a systematic, precise, and thorough approach to documentation and record-keeping. These elements represent integral components of any archaeological undertaking, as they facilitate the reconstruction of the excavation process and subsequent archaeological interpretation.

Module 2 aimed to acquaint students with the fundamental principles and techniques of documentation used in the field and after excavation. It covers topics such as the utilization and operation of digital recording tools, including tablets, and the relevant software for inputting data into digital notebooks and/or recording sheets. Furthermore, it addresses the integration of diverse forms of digital information, encompassing text,

drawings, images, and orthophotos, into a unified digital repository. The module also delves into the management, analysis, and visualization of digital data, which is stored in database form, to support the objectives of archaeological interpretation. Module 2 consisted of four units: *"The Significance of On-Site and Post-Excavation Archaeological Documentation"* (Unit 1), *"Digital Documentation in the Field"* (Unit 2), *"Digital Documentation after Excavation"* (Unit 3), and *"Post-Excavation Analysis of Digital Archaeological Data"* (Unit 4).

Module 3: Digital preservation and presentation of cultural heritage monuments and artefacts

Module 3 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 artefacts and ecofacts. Through Module 3, learners are able to produce and store digital documentation for the formal presentation of archaeological heritage (CAD software; Geographical Information System GIS Platform; GPS Data georeferencing, digital tools for artefacts drawings, Data Bases DB); 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 artefacts (3D restoration and 3D printing) and design a project of virtual restoration with practical application; be familiar with Virtual Reality (VR) and immersive VR, Augmented Reality (AR). The module is divided into four units: *"Digital documentation for the formal presentation of post-excavation archaeological heritage"* (unit 1), *"Photogrammetric and measurement techniques in connection with 3D imaging and drone of post-excavation archaeological heritage"* (unit 2), *"Virtual restoration and conservation of ornamental surfaces of monuments and artefacts (3D restoration and 3D printing)"* (unit 3) and *"VR and immersive VR, AR Augmented Reality"* (unit 4).

Module 4: Open-Air Museums and Experimental Archaeology

Module 4 introduces 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 to 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. Public archaeology will help young researchers to better understand archaeological processes and allow audiences to interact with archaeological knowledge. The module is divided into five units: *“What is an Open – air Museum?”* (unit1), *“The meaning and scope of Experimental Archaeology”* (unit 2), *“Live interpretation in AOMs”* (unit 3), *“How to best manage an open – air museum?”* (unit 4), *“Low-tech and High-tech Approaches in Archaeological Open-Air Museums”* (unit 5).

Conclusions

The analysis of data derived from the desk and field research contributes invaluable information for designing an effective digital course focusing on the application of digital tools in archaeology. This stands as the primary objective in designing and developing the DELTA project’s course. The blended course, titled *“Digital Excavation,”* was meticulously organized and delivered by the consortium of *“DELTA: Digital Excavation through Learning and Training in Archaeology”* between May and August 2021.

“Digital Excavation” spanned 15 weeks, totaling 160 hours of instruction. It combined online self-study through the DELTA platform with online sessions guided by tutors, ultimately providing 6 ECTS credits. The online segment of the course was administered through the DELTA platform, developed by the DAISSy research group at the Hellenic Open University.

Assessment for the DELTA course entailed self-evaluation quizzes, comprising multiple-choice and true/false questions within each module. Successful completion of the DELTA course required mastery of at least 80% of the learning material and graded activities, including the quizzes.

The overarching aim of the DELTA course was to empower archaeology students to update their knowledge and skills while developing proficiency in digital and 21st-century skills. The course comprised four modules, each one designed and delivered by a project partner. The third compo-

nent of the blended course involved a five-day, 40-hour training experience in the field – an integrated excavation for Archaeology students selected by each partner of the DELTA project.

The significant demand for digital skill training and the inability to convene in person during the global coronavirus pandemic underscored the value of blended learning and the DELTA course. The COVID-19 pandemic disrupted traditional teaching methodologies, prompting the search for innovative approaches to prevent such unexpected disruptions, further highlighting the importance and benefits of the DELTA project.

The global response to COVID-19 impacted virtually every aspect of life, spanning across continents and sectors, including culture and education. It became evident, more than ever, that emerging professionals in the field needed to acquire digital skills and competencies to effectively handle archaeological tasks. The COVID-19 crisis prompted a substantial surge in adult online learning, with training that initially commenced in traditional classroom settings transitioning to an online format. Students were encouraged to use the extra time freed up, often due to short-time work schemes, to pursue new training opportunities. As such, the crisis served as a compelling test of the potential of online learning.

The DELTA course effectively equipped its target group – Archaeology students, along with their educators, tutors, and professors – with fundamental digital skills and novel tools to enhance the documentation, preservation, and communication of archaeological discoveries and sites.

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