TRAINING STUDENTS IN THE USE OF DIGITAL TECHNOLOGIES IN ARCHAEOLOGY

DESK AND FIELD RESEARCH

Short Version

1 Introduction

The current research was carried out as part of the project DELTA (Digital Excavation through Learning and Training in Archaeology). Aim of the project is to design and development an innovative, open and blended course that combines the physical space of the excavation field and the digital space (virtual excavation, online learning) with the aid of new technologies, in order to train students in digital competences and the use of new technologies in Archaeology.

For the design of this course an extensive Desk and Field Research was undertaken in January-March 2020. Two methods of research were applied: (a) the Desk Research and (b) the Online Survey. Each method had different aims and methods of collecting and interpreting the relevant data.

Aim of the Desk Research was to explore the trends in the curricula of the three participating countries regarding the use of digital tools and applications in excavation and teaching. For this reason a special questionnaire form was composed and filled by the partners on the basis of the evidence found in the websites of universities and institutions related to studies in archaeology.

Aim of the Online Survey was to: (a) explore the existing digital skills and level of expertise of students and professionals in the three participating countries, and (b) identify which digital skills are considered essential for archaeological excavations. For this reason, a special online questionnaire form was composed by the partners, translated in the three national languages (Czech, Greek, Italian) and in English and filled by students and professionals after invitation.

2 Desk Research

2.1 The Desk Research Questionnaire

In January-February 2020 the three partners completed a Desk Research Questionnaire on the basis of evidence collected by the websites of universities and institutions related to archaeological education. The Desk Research Questionnaire was divided into three major groups of data:

Group A. General Institution Data: University/Department, Program of studies, Teaching Methodology, Courses on Archaeology, ECTS, Employment opportunities

Group B. Courses on Field Techniques: Description of course and excavation, Duration, ECTS, digital tools used in excavation explore the trends in the curricula of the 3 countries regarding the use of digital tools & applications in excavation & teaching

Group C. Digital tools and skills: (a) Digital tools used in the Excavation, (b) Digital skills provided to students

2.2 Analysis and Discussion of the Data

A large number of Programs of under- and post-graduate studies was explored. It is interesting to note that despite differences in the archaeological tradition and the overall academic system, the number of Departments of Archaeology is comparable among the three countries, with a rough analogy of 1 Department and 1 BA Program per 1 million people.[1]

	Greece	Czech Republic	Italy	Total
Departments	9	7	22	38

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[1] It should be noted that Desk Research in Italy was confined to the south and central part of the country, due to the large size of the country and the large number of departments and programs of archaeology. The population of the three areas is: Greece and Italy c. 10.5 million, Italy (south and central) c. 20 million.

BA Programs	9	21	21	51
MA Programs	17	15	26	58
School of Specialization	-	-	8	8
PhD	9	8	17	34

Table 1. Departments and Programs of Study related to Archaeology in the three participating countries

As expected, all BA Programs in Archaeology include a large percentage of courses on archaeology. However, programs in the Czech Republic are much more focused, including up to 100% courses on archaeology, than in Greece and Italy, where percentages are c. 37% and c. 30% respectively. This is because in Greece and Italy, archaeology courses are just part of a broader curriculum, which also includes courses on Literature, History and Classics. Furthermore, in Greece and Italy, BA Programs are not offered by pure Departments of Archaeology; in Greece they are offered by Departments of History and Archaeology and in Italy by Departments which in their title include disciplines such as Humanities, Classics, Letters, Literature, Arts, Social Sciences, Tourism, Education, History, Cultural Heritage and Human Sciences.

BA Programs	Greece	Czech Republic	Italy
Duration (semesters)	8	6	6
ECTS	240	180	180
Archaeology courses (% of total)	32-43%	100%	av. 30%
Archaeology ECTS (% of total)	35-54%	100%	av. 30%

Table 2. BA Programs in the three participating countries

In all three countries there is at least one course on Excavation Techniques per program, which includes compulsory practice in excavations.

BA Programs	Greece	Czech Republic	Italy (South)
Course on Excavation Techniques	1 pp	2-3 & 4-5 pp	1-2 pp
Compulsory practice in excavation	Y	Y	Y

Days of practice	10-21	10-15, 20-30	12-21
Use of digital tools in excavation	Y	Y	Y
Training in the use of digital tools	Y	Y	Y

Table 3. Courses and Practical Training in Excavation Techniques in the BA Programs of the three participating countries (pp: per program)

The use of digital tools is the norm in all excavations, and the students are trained in the use of these digital tools. The digital tools reported as used in excavation training are almost the same in all three countries and include mainly Digital Notebooks and/or Cards, Use of Databases, Photogrammetry, 3d Graphics & Virtual Reconstruction, GIS, and the use of GPS and other topographic instruments.

3 Online Questionnaire

3.1 The Online Questionnaire

In January-February 2020 a special questionnaire form was composed in English and translated by the partners in the three national languages (Czech, Greek and Italian). The questionnaire was transferred into Google Forms format and uploaded online in the Google Forms platform. A special invitation was sent via email to students, university professors, researchers and professionals of archaeology and related subjects. The email provided the necessary information about the project, the link to the project website, and the link to the questionnaire.

The Online Questionnaire was anonymous, and the questioned person was only kindly asked, but not obliged to, provide an email for future information and dissemination purposes. The questionnaire comprised four major categories of questions:

Part A. General personal data: Current specialization and position, Affiliation, Country, Gender, Age. Educational Level

Part B. Training in digital excavation methods and techniques: (a) BA courses which include excavation training in their curricula, (b)

digital applications used in excavation practice, (c) digital educational tools used in excavation training

Part C. Professional experience in digital excavation methods and techniques: (a) professional experience in excavations, (b) Digital applications used in these excavations

Part D. Digital skills/competences/tools which are considered essential/important: (a) digital skills considered essential for an excavation project, (b) digital educational tools considered important for a training course, (c) previous experience in Massive Open Online Course (MOOC).

3.2 Analysis and discussion of the data

3.2.1 PART A: General Personal Data

A total number of 245 responses were collected by the online survey (Greece: 119, Italy: 70, Czech Republic: 56). As expected, the overwhelming majority (97%) of the responders were archaeologists. The sample was representative in terms of gender, age, position and educational level, but some interesting observation can be made. Regarding gender, the over-representation of females is actually representing the real situation in the academia and labour market, particularly in Greece and Italy. Regarding age and affiliation, the over-representation of lower age categories (>40 years) and responders affiliated to universities, was a conscious decision, because the target of the DELTA project is students and the younger generations of current and future archaeologists. In any case, the figures seen in Table 4 imply that the data collected by the Online Questionnaire closely reflect and represent the opinions, ideas, expectations and aspirations of a wide variety of people studying and working in archaeology, in all three countries.

Gender		Age		Position		Affiliation		Education	
M	36	18-30	50	Public Sector	12	University	78	BA students	18

F	62
NA	2
Total	100

30-40	22
40-50	18
50-60	7
60-70	2
70+	0
Total	100

Private Sector	9
Professors	12
BA Students	17
MA Students	16
Specialization[2]	5
PhD Students	15
Researchers	12
Graduates	2
Total	100

Research Center	7
Public Service	8
Private Company	5
Museum	2
Total	100

BA holders	20
MA holders	27
PhD holders	27
Specialization Diploma holders [3]	9
Total	100

Table 4. Responses on the basis of gender, age, current position, current affiliation and education level (in %)

3.2.2 PART B: Training in Excavation Methods during Studies

Courses in excavation methods and techniques: About three quarters of the responders (76%) followed, during their BA studies, courses which included training in excavation methods and practices. This suggests that there is a good background of excavation training in most students of archaeology and in all the relevant university curricula.

Digital tools used in the excavation: On the other hand, it is important to emphasize that from these courses only one third (34%) included training in digital applications during the excavation. This means that digital skills have not yet been systematically incorporated in the excavation training courses. It should be, also, noted, that there are sharp differences between the three countries

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[2] Schools of Specialization are a particularity of the Italian educational system. After the MA Degree (Lauree magistrali), it is possible to apply and follow the post-graduate School of Specialization in Archaeology (IIIrd cycle, limited number of students), providing a Diploma of Specialization in Archaeology. These post-graduate courses tend to be more focused on a specific subject within the archaeological discipline, and aim at training specialists and offering the necessary professional skills.

[3] See above, n. 2

in this respect; in the Greek questionnaire the percentage is only 17%, in the Italian 39% and the Czech 59%. In the Greek case alone, training in digital applications started to be included in the curricula only 5 years ago.

Furthermore, as expected, higher percentages of training in digital applications is seen in the two lower age categories (18-30: 25%; 30-40: 35%), while in the higher ones the percentage is much lower (40-50: 20%; 50+: 17%). The following table summarizes the frequency of various digital applications included in excavation training courses. Numbers correspond to the percentage of positive answers against the total of 245 answers:

	Total
Notebooks composed in the field	29
Cards composed in the field	41
Notebooks composed after excavation	54
Cards composed after excavation	38
Digital Photos	78
Digital Drawings	44
Photogrammetry	56
3D graphics	30
Digital presentation of monuments & artifacts	13
Dissemination of excavation results to the public	32
Digital Exhibition	2
Digitization of collections and archives	11
Managing digital archives and/or collections	17
Audience engagement	17
Communication	19
Storytelling	6
Development of digital applications	2

Use of laser scanners	2
Use of Autocad	2
Use of GIS applications	2
Use of topographical instruments	2

Table 5. Frequency of digital tools included in excavation training courses (in %)

As expected the most frequent tool is Digital Photography, followed by a group of relatively frequent applications such as Photogrammetry, Notebooks composed after the excavation, Digital Drawings and Cards composed in the field and after the excavation. Less frequent are applications such as Dissemination of excavation results, 3D Graphics, and Notebooks composed in the field. Rather rare are digital applications related to Communication, Managing of Digital Archives, Audience Engagement, Digital Presentation of Monuments and Artifacts and Digitization of Collections and Archives. Finally, extremely rare or almost absent are applications related to Storytelling, Application Development, Digital Exhibitions, and use of GIS applications, Topographical Instruments and Laser Scanners.

Digital educational tools in excavation courses: Despite the extensive use of digital tools in excavation techniques, the use of digital educational tools in courses on Excavation methods and Techniques is very limited, since only 12% of the responders gave a positive answer to this question. Concerning the types of digital educational tools the small amount of positive responses does not allow safe statistical conclusions, but the prevailing tool is E-learning (70%), followed by Webinars (13%) and MOOC (9%).

3.2.3 PART C: Professional experience in digital excavation methods

Professional experience: About two third of the responders (68%) participated in excavations after their undergraduate studies. Almost three quarters of these excavations (74%) use digital applications as part of their excavation methodology. This is surprising, because it comes in contrast with the significant lower percentage of university excavations with training in digital excavation applications (34%). It

seems that excavation training in universities has not yet included digital advances that characterize excavations outside the university curricula. Minor differences exist between the three countries, since the percentage in the Greek sample is lower (65%) than the Italian (77%) and in the Czech (89%), suggesting a relatively slower adoption of digital techniques in Greek excavations. Whatever the case, it seems clear that in all three countries excavations have started to adapt to the digital age faster than the university training excavations. The following table summarizes the frequency of various digital applications, which are used in excavations. Numbers correspond to the percentage of positive answers against the total of 245 answers:

	Total
Notebooks composed in the field	39
Cards composed in the field	50
Notebooks composed after excavation	68
Cards composed after excavation	53
Digital Photos	95
Digital Drawings	69
Photogrammetry	73
3D graphics	44
Digital presentation of monuments & artifacts	33
Dissemination of excavation results to the public	58
Digital Exhibition	8
Digitization of collection and archives	31
Managing digital archives and/or collections	24
Audience engagement	35
Communication	39
Storytelling	14

Development of digital applications	15
Hardware for digitizing drawing	1
Use of GIS applications	2
Use of topographical instruments	4

Table 6. Frequency of digital tools used in excavations (in %)

As expected the most frequent digital tool is Digital Photos, followed by a group of very frequent applications such as Photogrammetry, Digital Drawings and Notebooks composed after the excavation. Less frequent applications are Dissemination, Cards composed in the field and after the excavation, and 3D Graphics. An even less frequent group of digital applications includes Notebooks composed in the field, Communication, Audience Engagement, Digital Presentation of Monuments and Artifacts and Digitization of Collections and Archives, and Managing of Digital Archives. Finally, extremely rare or almost absent are applications related to Application Development, Storytelling, Exhibitions, and the use of GIS and Topograhical Instruments. Some deviations from average in the three countries may be seen.

3.2.4 PART D: Which digital skills/competences are considered essential by archaeologists for an excavation project

Digital skills considered as essential for an excavation project:
In the question concerning the digital skills which are considered by archaeologists as essential for an excavation project, the answers are summarized in the following table. Each number represents the percentage (%) of the responses that each digital tool received against the total of 245 responses:

	Total
Notebooks composed in the field situ & after the excavation	42
Digital Drawings	51

Photogrammetry	56
3D graphics	56
Digitizing Monuments & Artifacts	49
Dissemination of excavation results to the public	39
Digital Exhibitions	36
Digitization of collections and archives	34
Managing digital archives and/or collections	31
Audience engagement	27
Communication	25
Storytelling	22
Development of digital applications	22
Creating and managing data bases	0
Hardware for digitizing	0
Use of GIS applications	1
Virtual restoration	0

Table 7. Digital skills considered as essential by archaeologists for an archaeological project (in %)

Most of the top-voted skills or applications are related directly with in-situ excavation methods and techniques. Photogrammetry and 3D Graphics are considered most essential, followed by Digital Drawings, Digitizing of Monuments and Artefacts and Digital Notebooks. Less voted are skills related to Public Archaeology and outreach, such as Dissemination of excavation results, Digital Exhibitions, Audience Engagement, Communication and Storytelling, as well as post-Excavation Management, such as Digitization and Managing of Collection and Archives. Surprisingly low is the percentage of the Development of digital applications (22%).

It should be noted, that there are interesting divergences in the preferences of the responders, on the basis of their current position and level of education.

Archaeologists in the Public Sector consider as less important (in comparison to the average) the Notebooks, the Dissemination of the excavation results, the Digitization and Managing of Collections and Archives, and the Audience Engagement.

Archaeologists in the Private Sector think as less important (in comparison to the average) the Digitizing of Monuments & Artifacts, the 3D Graphics and the Managing of Collections and Archives. On the other hand they consider as more important the Digital Drawings and the Dissemination of excavation results.

Teaching staff in universities consider as less important (in comparison to the average) the 3D Graphics, the Digitization of Monuments & Artifacts.

Researchers are much closer to the average in all types of digital tools, but, overall, they seem to show higher preference for Post-Excavation Management (Managing Collections & Archives) and lower preference to field-related digital applications (Notebooks, Photogrammetry, etc.). This is expected, since research work is mostly characterized by the post-excavation processing of data in the library/office, rather than by the recording and collection of these data in the field.

Finally, BA, MA and PhD students consider all digital tools and skills as very important, since their responses are higher than the average in all types.

Overall, it seems that under- and post-graduate students appreciate extremely high all types of digital tools and are eager to acquire digital skills in (almost) all applications. Professional archaeologists in the Public and Private Sector seem to be less interested for digital skills related to post-excavation applications, while Researchers are interested on tools and skills related more to post-excavation management and less to field techniques. Each number represents the percentage (%) of the responses that each digital tool received against the total of 245 responses:

	Avrg	Public Sector	Private Sector	University Professors	Research	BA students	MA students	PhD students
Notebooks in the field & after	42	21	38	45	33	57	56	41
Digital Drawings	51	48	67	41	37	57	64	49
Photogrammetry	56	62	52	48	40	55	62	65
3D graphics	56	48	43	41	43	71	62	70
Digitizing Monuments & Artifacts	49	41	33	31	40	62	69	43
Dissemination	39	21	48	34	40	50	56	32
Exhibition	36	38	29	28	33	36	51	35
Digitization	34	17	38	28	30	48	49	27
Managing archives	31	21	19	38	43	26	46	27
Audience engagement	27	14	33	21	23	36	26	38
Communication	25	24	33	21	20	24	33	24
Storytelling	22	17	14	24	20	36	23	19
Development of digital apps	22	14	5	24	17	10	36	38
Data base	0	0	0	0	0	0	0	0
Use of GIS	1	7	0	0	3	0	0	0
Virtual restoration	0	0	0	0	3	0	0	0

Table 8. Digital skills considered as essential by archaeologists for an archaeological project in the basis of their current position (in %)

Digital educational tools considered important for a training course on excavation methods and techniques: In the question concerning the importance of the various educational tools for a training course on digital excavation method and techniques, there is a clear emphasis on tools and methods which are related to hands-on experience and in-situ practicals: (1) Training In Situ was voted

as Extremely Important by 80% of the responders, (2) Hands-on Sessions by 66% and (3) Sharing Expertise with peers by 57%. Less important were considered other types of tools, such as Online Publications, Digital Handbook and Online Resources, which were voted as Extremely Important by nearly half of the responders (54%, 41% and 40% respectively). On the other hand, it is surprising that distant-learning tools, such as Webinars and Online Courses, were voted as Extremely Important only by one fourth of the responders (24% and 22% respectively). The answers are summarized in the following table, in which each number shows the percentage (%) of the responses that each digital educational tool received against the total of 245 responses:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not Important
Training in situ	80	16	3	1	0
Hands-on sessions	66	28	6	1	0
Sharing expertise with peers	57	30	10	3	0
Publications available online	54	38	12	1	1
Accreditation	46	26	12	11	5
Digital handbook and syllabus	41	33	20	5	1
Online resources	40	36	19	5	1
Methods of assessment	27	33	20	16	4
Webinars	24	28	31	12	5
Online courses	22	29	30	17	3

Table 9. Digital educational tools considered as essential by archaeologists for a training course on excavation methods and techniques (in %)

Massive Open Online Courses (MOOC): Finally, only 17 out of 245 respondents (7%) have taken part in MOOCs, and have some experience in this digital method of learning. The percentage is very small and not suitable for any analysis. The main point arising from

this question is the lack of MOOCs concerning digital application in excavation techniques, in the three countries and beyond.

4 Final Discussion

The analysis of the data deriving from the Desk and Field Research contributes valuable information for the design of an effective digital course on the application of digital tools in archaeology, which is the main objective of Intellectual Output 1 and of the DELTA project, in general. A summary of the results of the analysis made above is needed before assessing their importance for the design and development of the DELTA course.

The evidence from the Desk Research Questionnaire, in particular, provided a thorough picture of the archaeological curricula in the three participating countries, concerning:

(a) higher education courses on Excavation Methods and Techniques

(b) the use of digital applications in Archaeological Excavations

(c) the use of digital educational tools in courses about Excavation Methods and Techniques

In all three countries the archaeological curricula include a large number of courses on Archaeology, Excavation and Field Methods and Techniques. However, it became clear that BA studies in the Czech Republic are much more focused on archaeology, since they consist almost exclusively of courses on archaeology, while in Greece and Italy the curricula include also other courses on related subjects, such as History, Ancient Literature and Classics.

On the other hand, the archaeological curricula in all three countries include compulsory practical training in Excavation and Field Methods and Techniques, with a varying duration, usually between 10 and 21 days. Furthermore, of special importance for the DELTA project is the fact that in all educational excavations the use of digital tools is the norm, and students are trained in the application of these digital tools in the field. In Greece, however, the application of digital tools

excavations and the training of students is a rather recent phenomenon.

Useful conclusions were also made on the basis of the analysis of the Online Questionnaires. Because these Questionnaires were filled in by students, scholars, colleagues and professionals, they provide valuable insights regarding the existing skills and the aspirations of the people engaged in the discipline of Archaeology. Furthermore, because all categories of age, gender, position, affiliation and educational level are well represented in the sample, the answers reflect the opinions, ideas, expectations and aspirations of almost all people related to archaeology. Four points are the most important regarding the aims and objectives of the DELTA project.

The first point concerns the training of students in the use of digital tools in archaeology. There are sharp differences between the three countries, with Greece having the lowest percentage (17%), the Czech Republic the highest (59%) and Italy lying in between (39%). These differences are partly because of the belated introduction of digital tools in Greek excavations. Nevertheless, even in the more digitally advanced countries, there is still a large percentage of archaeologists who feel digitally "illiterate", regarding the use of digital tools in archaeological projects. This observation reinforces the *raison d'etre* of the DELTA project and its major premise that a special course on digital applications in archaeological projects should be included in the relevant academic curricula.

The second point is the acknowledgment of the limited range of digital tools used in archaeological projects, and in which students of archaeology are trained. The analysis of the responses to the Online Questionnaire showed that students' training is confined to digital tools related to excavation recording, such as the use of Digital Notebooks/Cards, Digital Photos and Photogrammetry; in contrast, other tools related to post-excavation tasks, such as Public Engagement, Dissemination and Communication of archaeological knowledge, and Digital Presentation and Management of objects, archives and collections are rarely included in the syllabus of these courses.

The third point is related to the fact that digital educational tools have rarely been applied in courses of Excavation Methods and Techniques. In Greece they are virtually absent (1%), while even in the more digitally advanced curricula of the Czech Republic the percentage is disappointingly low (26%), with Italy lying in between (18%).

Finally, the fourth point, which may not be of a surprise, is that students and junior scholars (i.e. responders of 20-30 and 30-40 years of age, and students in BA, MA, Specialization and PhD Programs) are eager and interested to learn as many digital skills as possible, covering almost every aspect of excavation and post-excavation work. This comes in contrast to the preferences and aspirations of more senior scholars and professionals, who are more selective, being interested mostly on digital tools related to their own work and research.

The above points corroborate and justify the main objectives of the DELTA project regarding the design and development of a special course which will train students and professionals of archaeology to the use of digital tools in archaeological projects. The design of this course should be made in a way, which will allow easy and seamless incorporation in the existing archaeological curricula.

The new course should include training in as many digital tools as possible. This means that it has to include not only the tools that are usually applied in excavation tasks, such as Digital Notebooks, Drawings and Photogrammetry, but also tools for post-excavation tasks, such as Managing of Archives and Collections, Digital Presentation and 3d Reconstruction of Monuments and Artifacts, as well as the Dissemination and Communication of excavation results, Storytelling, and Engagement of the Public in the archaeological work.

Finally, one of the most important deficiencies of the existing archaeological curricula is the limited (if any) application of digital educational tools in archaeological training. The application of such tools in the blended course, which is planned by the DELTA project not only will provide students of archaeology with new digital skills,

but it will also enable a more effective integration of classroom lessons with field training.