

## Article

# Teaching and Learning of Cultural Heritage: Engaging Education, Professional Training, and Experimental Activities

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**Abstract:** The preservation of cultural heritage through education and training has always been a relevant issue and, sure enough, can contribute to the accomplishment of the Sustainable Development Goals of Agenda 2030 (e.g., 4: Quality education, 8: Decent work and economic growth, 11: Sustainable cities and communities). The pandemic experience substantially influenced this topic for two key reasons. First, it has revolutionized the approach to teaching and learning activities, involving technological and digital innovations in this area for extreme and urgent necessities. The second aspect is that it has encouraged the rediscovery of minor heritages closer to one's own territorial identity, strengthening the link with the local community. Understanding the role and importance of cultural heritage begins in the school; therefore, education is an essential and indispensable stage. At all educational levels, beginning with primary school, the necessary training activities for specific professional figures should be implemented. The transformation related to the cultural heritage professional figure must include both awareness of heritage value and excellent practical and theoretical skills. The research presented focuses on proposing new training paradigms that are highly professionalizing and involving.

**Keywords:** cultural heritage; preservation; education; learning; experimental workshop; COVID and post-COVID teaching; innovative teaching; didactic training models; digitalization



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## 1. Cultural Heritage and Education, a Brief Introduction

“Cultural heritage includes artefacts, monuments, a group of buildings and sites, museums that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, scientific and social significance” [1]. Cultural heritage safeguarding through education and training has always been a topic of great interest; for instance, it is directly linked to achieving target 11.4 (Strengthen efforts to protect and safeguard the world's cultural and natural heritage) of goal 11 (Sustainable cities and communities) of the 2030 Agenda for Sustainable Development [2]. Moreover, heritage preservation education can contribute to the accomplishment also of goal 4 (Quality education) and, indirectly, of goal 8 (Decent work and economic growth), offering training so that there are positive implications for new jobs and new professional figures. In Italy, the Ministry of Culture, Directorate General for Education, Research and Cultural Institutes promotes cultural heritage education, considering it a primary objective, also in the implementation of article 9 of the Constitution: “The Republic shall promote the development of culture and scientific and technical research. It shall safeguard the natural landscape and the historical and artistic heritage of the Nation” [3,4].

The first *Piano Nazionale per l'Educazione al patrimonio*—PNE (National Plan for Cultural Heritage Education) [5] was published on 21 December 2015 by the governmental body *Direzione Generale Educazione e Ricerca del Ministero dei Beni e delle Attività Culturali e del Turismo*, in line with the MIBACT (Ministry of Culture) reform and with law 107 called *La Buona Scuola* [6]. The program promotes heritage knowledge and its educational role by defining local planning objectives and identifying general best practices as references.

Three elements prove to be fundamental to initiating cultural heritage education in local processes: communication with and towards cultural subjects and citizens; research and training; and partnerships and relations with the territory [7]. Indeed, the governmental body prepares and updates the PNE each year [8], which aims to (i) consolidate governance for heritage education, also by strengthening relations between institutions; (ii) promote the planning of the educational sectors, making the educational/training offer systemic and innovating areas and practices of heritage education; (iii) develop processes for the acquisition, analysis and dissemination of results, through the preparation of methods of analysis and the improvement of both internal and external communication inside institutions. These three principles are described through specific lines of action and interventions and share some transversal objectives, which can be summarized as:

- accessibility (physical, socio-economic, sensorial, cognitive);
- communication (as a subsequent process to the cultural heritage recognition);
- participation (everyone has the right to freely participate in the community's cultural life, enjoy the arts and share in scientific advancement and its benefits) [9,10].

The PNE aims to bring local planning within a general reference frame so that the single initiative can be part of a wider system to which it contributes directly. What does "Educating on cultural heritage" mean today for our research? From the teaching point of view, it means reviewing the traditional training offer and proposing one suitable for developing a professional profile with theoretical, practical and digital skills capable of dealing with the complexity of this topic.

The PNE recognizes cultural heritage, both tangible and intangible, as a widespread and constantly evolving resource, but its value also depends on the level of participation and decision-making it generates.

In order to accomplish this aim, cultural heritage must be recognized as a 'common good'. This evolution of the meaning of cultural heritage can only be possible with strong support from all institutions responsible for the education of each individual.

Heritage education aims at achieving medium- and long-term objectives aimed at the lifelong education of the individual. Therefore, 'education and cultural heritage' today means the development of flexible and interdisciplinary paths; the improvement of learning processes and research skills; the broadening of specific competencies and the acquisition of relational, communication and project skills. In the formulation of new educational paths, these aspects become decisive in preparing the professional figures of the future.

For professionals and teachers involved in heritage education, it is necessary to set up dedicated training courses and opportunities for research and updating so that disciplinary knowledge can be renewed and both didactic and planning skills can be updated.

For everyone, but particularly for teachers, communication skills and keeping up to date are prerequisites for generating the interest necessary for the positive transfer of knowledge and critical spirit to those who want to work on cultural heritage.

'Heritage education' means increasing knowledge, both individual and community-based, to ensure the care, valorization and transmission of cultural heritage.

In Italy, at the academic- and ministerial-level, the debate on cultural heritage related to conservation, safeguarding and education has always been, even historically, very active [11,12]. It follows that the 'heritage education' topic is certainly also the outcome of what has been debated and what has been implemented [13], also in comparison with other international experiences [14–17] and even in a controversial manner [18].

Heritage education involves all aspects, from the technical ones related to 'know-how' to those socio-cultural ones that heritage itself generates. [19,20].

This paradigm shift has also led to a mutation of the very concept of 'heritage education', because it has become increasingly evident that safeguarding and care derive from a progressive realization of the value of heritage, accompanied by an indispensable ability to implement quality and effective interventions.

There is a clear need for professionals with up-to-date technical skills, capable of ensuring timely knowledge of the cultural heritage, assessing emergencies based on risk analysis, and implementing monitoring, diagnostic and maintenance actions.

To safeguard/cure, it is not enough to know how to use technology and information tools well; it is necessary to spread awareness to build a participatory and informed mindset. A change of this magnitude can only take place in educational institutions. Along the educational pathway, the concepts of 'cultural heritage, conservation, preservation, care' must be introduced, ending with the concept of 'common good' [21]. This sensitivity is achieved by a decisive and conscious socio-cultural intervention of educational institutions throughout the entire educational pathway from primary school to university and beyond.

However, the PNE indications can be applied to all disciplines. This paper focuses on the learning activities linked to the disciplines of Surveying, Representation, Conservation and Restoration in the architecture, building heritage and landscape fields. Above all, the research wants to highlight the importance of an interdisciplinary approach to these teachings for cultural heritage documentation and the practical connection among surveys, modelling and projects based on derived data.

#### *Cultural Heritage and Professional Figures*

Protecting and preserving cultural heritage require specialized professionals with a wide range of knowledge and skills. In Italy, basic training for those involved in the protection and enhancement of cultural heritage is provided by schools and universities [22,23]. Several university campuses offer three-year courses of study and master's degrees (3 + 2), possibly accompanied by a further specialization (Appendix A). The professional figures that traditionally work closely with cultural heritage are the Restorer, Restoration Technician, Architect, Physical Anthropologist, Archaeologist, Archivist, Librarian, Demoetnoantropologist, Expert in diagnostics and science and technology applied to cultural heritage and the Art Historian [24]. These are all recognized professional figures, some of which are regulated and others not (Appendix A).

Different professionals, each with their own set of skills and abilities, evaluate and define the state of conservation of cultural heritage and implement the necessary measures to limit the degradation processes and thus ensure their preservation. Whoever works on cultural heritage must know how to analyze and interpret data, must know how to plan and direct interventions and must know how to coordinate with all the other professional figures that need to be involved for the success of the activities. Some skills are common to all professionals working on cultural heritage and are transversal skills necessary for the success of projects:

- being able to conduct research and collect information, not only of a historical nature, but all that contributes to the Cultural Property description;
- being able to conduct a preliminary examination of the heritage and its environment data, the executive techniques and the constitutive materials of both original and possible interventions and evaluation of the degradation conditions and the interactions between the work and its context;
- to be aware of the various phases of the intervention to be performed in order to plan competent phases at the appropriate time;
- know how to choose the proper instrumentation and equipment for the interventions/activities to be carried out;
- control the correct execution of the activities and verify the quality of the results;
- know how to manage the activities, taking care of all aspects, including administrative and worksite aspects;
- be able to document the results in 'technical-specific' venues and others, not necessarily composed of an audience of insiders.

Given the general framework of skills required, while retaining in part the historical-critical and technical structure of traditional courses of study, the new schools and the new training courses offered in the three-year degree and master's degree are characterized by

greater attention to the management and economic aspects, as well as those related to the use of technology and a more incisive training “in the field”.

Italian Universities deal with various issues related to the management and use of cultural heritage and offer specific training courses for those who want to deepen their knowledge of the historical, architectural and landscape heritage [25]. The broad horizon of the universe of cultural heritage, especially in Italy, justifies the wide spectrum of teaching methods and educational facilities. In this sense, the Universities offer training courses that take place in addition to the ordinary courses and represent, for the students, a moment of actual theoretical–practical study of specific topics (e.g., summer schools, first and second-level masters, updating courses and PhD courses, with topics on material and immaterial cultural heritage) [26–35]. Several courses were halted due to the pandemic, but they are all gradually recovering. Each course is characterized by specific contents and aims and provides the right mix of theoretical competencies and practical skills. It must be emphasized that today the elaboration of the concept of cultural heritage in educational processes is strongly conditioned by the availability of digital tools (many) that allow one to document, detect, study and safeguard the heritage itself.

With specific reference to the metric survey activity, an indispensable and preparatory activity to any intervention on the heritage, it is customary today to talk about cultural heritage and laser scanners, photogrammetry, 3D models and digital twins. Recent advances in the field of technology have made available tools that can also be used to ‘do’ teaching and make teaching more engaging, putting theory into practice ‘in the field’ using different/appropriate tools. This factor forces us to modify both the contents and teaching methods without losing sight of the training ‘needs’ for the cultural heritage sector.

Identifying appropriate content and methods is the role of didactics, whereas research must respond to problems by proposing tools and technologies that provide effective solutions. For the effectiveness of summer school courses, ‘modular didactics’ has been employed. This formula envisages the organization of teaching-learning activities through distinct and self-sufficient units characterized by a specific thematic core interdisciplinary. The didactic modules have a predetermined number of hours and certify the acquired competencies through educational credits. This method allows the creation and development of comparable adult education or lifelong learning strategies. The strategy related to modular teaching is indirectly prompted by the European integration process, which has posed the need to ensure a substantial equivalence of competence standards acquired in the systems of the different countries [36].

These courses respect and enhance the autonomy and specificity of educational institutions. The didactic is organized on specific topics, clearly identifying the learning objectives set. When the activities proposed in the courses concern the documentation of cultural heritage (here understood as a metric survey), the teaching modules must necessarily contain:

- (i) theoretical references to the latest available technologies;
- (ii) the most efficient data-processing/management methods and, where possible,
- (iii) the use of state-of-the-art instruments during on-field activities.

In this context, summer schools do not involve collaborative teaching<sup>1</sup> but rather interdisciplinary teaching [37,38]. The team of professors and tutors teaches the same group of students but teaches different disciplines and skills. The didactic approach has a strong multidisciplinary connotation, because the skills of a topic are related to the needs of another field. For instance, the survey outputs are represented and made available for all conservation/restoration-related needs.

Usually, the survey activities aim to know the dimensional data, the geometric characteristics of the objects under study and the description of materials and construction techniques used. Accurate documentation constitutes indispensable support for the protection and safeguarding of cultural heritage.



Today, architectural and archaeological surveys must be expeditious, detailed, accurate and repeatable where and when necessary. An operator with specific technical skills is required to conduct a survey with these characteristics. The ease of use of tools and software should not be confused with equal ease of producing the finished product. For some years now, data acquisition has required much less knowledge than in the past; just think of the laser scanner instrumentation that in a decade has ‘overturned’ the way of working in the field.

The widespread use of the tool does not coincide with equally easy data processing and accurate/complete technical output generation. In recent years, the availability of increasingly automated equipment has changed the competencies of a classical operator.

There has been a shift from a highly specialized and individual type of professional figure (the old topographer or restorer) to one that is still specialized but works as part of a team and with other scientific fields. It is the task of school education to transmit the theoretical principles and to become accustomed to the use of standards for verifying the quality of the acquired data. In addition to the skills necessary to carry out one’s intervention, one must possess the tools to verify and validate the accuracy, completeness and appropriateness of the information collected.

It is useful to reiterate the importance of training students and professionals in critical thinking and data quality verification, along with training them in the correct use of tools and methods in practice. It is necessary to know how to use the tools of documentation/investigation (both the historical ones and those made possible by technological innovation), together with those of self-assessment and evaluation.

Today the professional figure is changing precisely because some software applications, with the latest research developments, require much less knowledge and ‘broaden’ the base of users of tools and methods, which were previously the domain of ‘experts’ only.

A clear example is a photogrammetric survey, which has seen its evolution precisely in the direction of simplification. Digital cameras and increasingly user-friendly software have brought many technicians and scholars from fields other than surveying closer to using these techniques for the generation of products (3D models, orthophotos) as documentation and support for various types of analyses.

The speed of evolution in instrumental/information technology [39–42] is so rapid that training and, above all, conscious updating are and will be necessary prerequisites for all those who, in various capacities, want to deal with cultural heritage. Presented here are some of the experiences conducted in recent years, before the COVID pandemic, during and after. The activities involved professionals, university students and primary and secondary school students.

## **2. Cultural Heritage Education: Universities and Summer Schools**

### *2.1. Context*

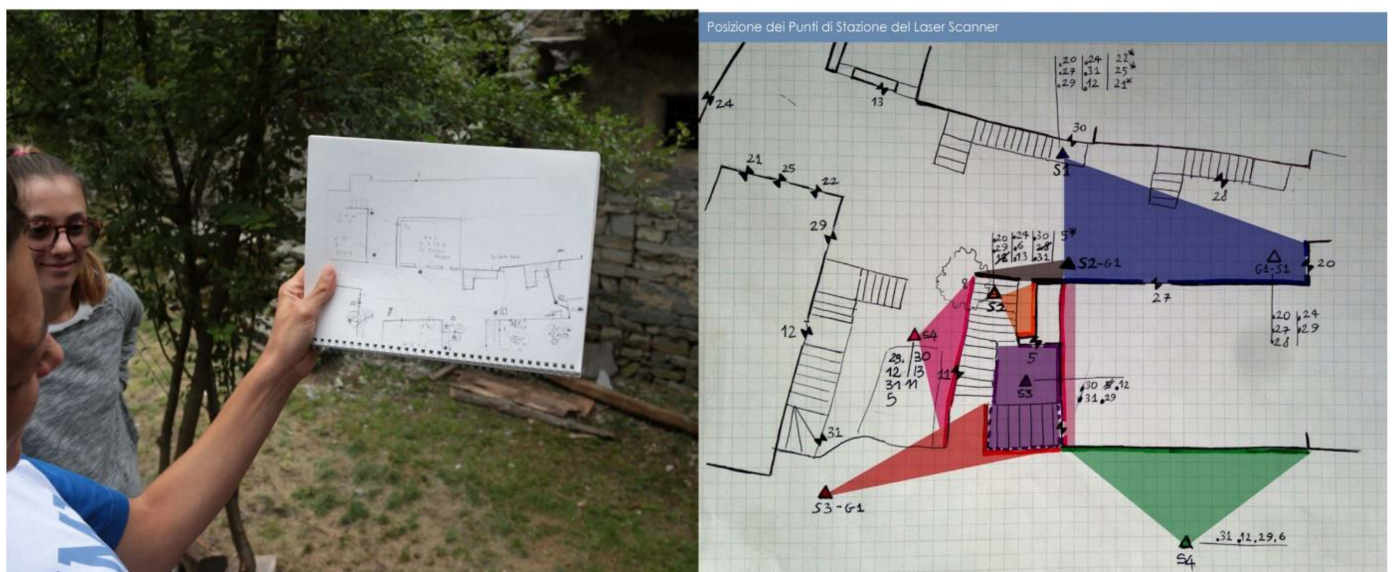
Regarding cultural heritage documentation, geomatics survey techniques are the in-depth topics of training courses and summer schools for professionals and university students. These activities aim to create specific skills in the field, with a solid theoretical basis supported and complemented by practice.

The primary objectives are to enable students to utilize surveying equipment (topographic, laser scanners and photogrammetric) to critically process the surveyed data and produce relevant documentation and, most importantly, to learn a methodology of working based on proper theoretical preparation. In general, the course format balances the contributions of theoretical preparatory lectures, on-site survey campaigns and in-office data processing. The experiences conducted at the Politecnico di Milano starting from 2010 (Appendix B) have seen the implementation of courses lasting 10 days, all spent in the chosen location in direct contact with the cultural asset that is the subject of the metrological and not only of study [43,44].

In planning the activities, every effort is made to alternate the theoretical lectures and seminars with the accompanying practical activities so that the theoretical is immedi-

ately connected to the practical. Theoretical concepts are often introduced during on-site activities in direct contact with the instrument (laser scanner, total station, camera), so a good practice is supported by adequate theoretical training. The activities distribution is structured such that about 20% of the time is allocated to theoretical parts, 40% to field activities and the remaining 40% to data processing and technical outputs elaboration.

Essential is the on-site activities and the direct contact with the instrumentations. Students design and practice the survey of their case study, working independently under the direct supervision of lecturers and tutors. Figure 1 shows one of the first on-site activities carried out with the students, i.e., the drawing of the sketches and the survey design; in this case, the choice of target locations and laser scanner stations.



**Figure 1.** The on-site activity was carried out with students: sketches drawing with the target positions and laser scanner stations.

## 2.2. Methods

The various activities that characterize this course typology involve using different tools, hardware and software, which inevitably change from year to year, following the evolution of technology and computer science. In fact, during these training courses, not only traditional surveying techniques are illustrated and practiced, but also and especially the more innovative ones. Therefore, the different editions of training courses and summer schools have changed the type of tools available and the data elaboration method.

Figure 2 shows photos taken during various editions of the summer schools from 2010 to 2019 held in the archaeological site of Nemi (Rome), the rural village of Ghesc (Domodossola) and the *Sacro Monte* of Domodossola. The shots demonstrate how the instruments used have changed to keep up with the progress of technology and computer science. For example, as the summer school editions changed, we moved from the air balloon to the UAV (Unmanned Aerial Vehicle) for aerial surveying. Instead, the latest edition showed the potential of the latest mobile scanner technologies (such as the backpack).

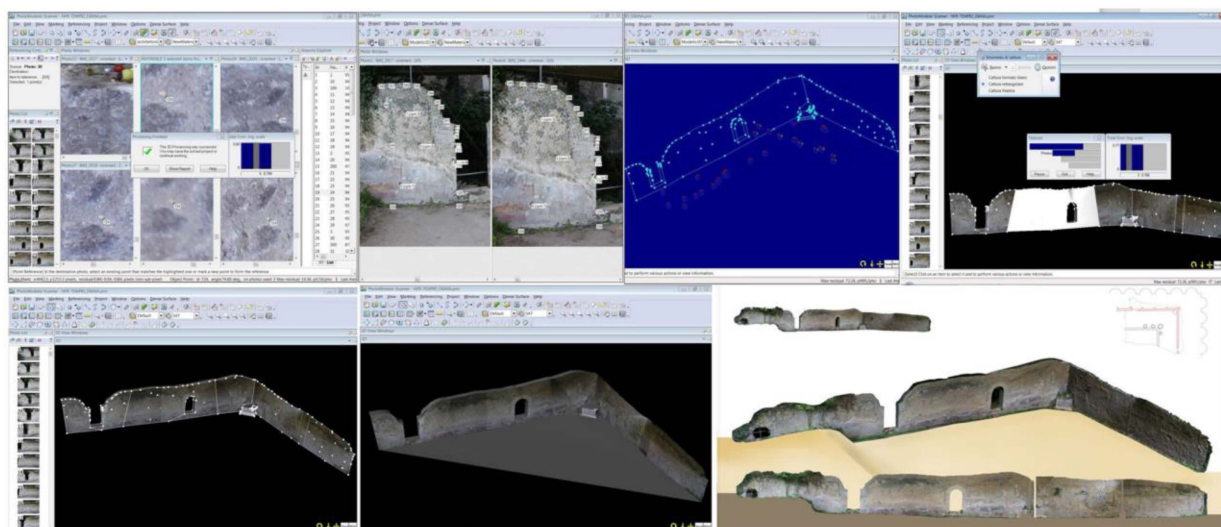
Instead, Figure 3 depicts the essential phases that define the standard photogrammetric pipeline: (i) design and capture of stereoscopic images, (ii) recognition of homologous points and (iii) manual reconstruction of surface profiles (in the specific case, the temple walls).





Figure 2. The photographs shot at various Summer School editions from 2010 to 2019 show how the employed instruments have changed to stay up with technology and computer science.





**Figure 3.** Conventional photogrammetric workflow (2010–2011): design and acquisition of stereoscopic images, recognition of homologous points and reconstruction of surface profiles.

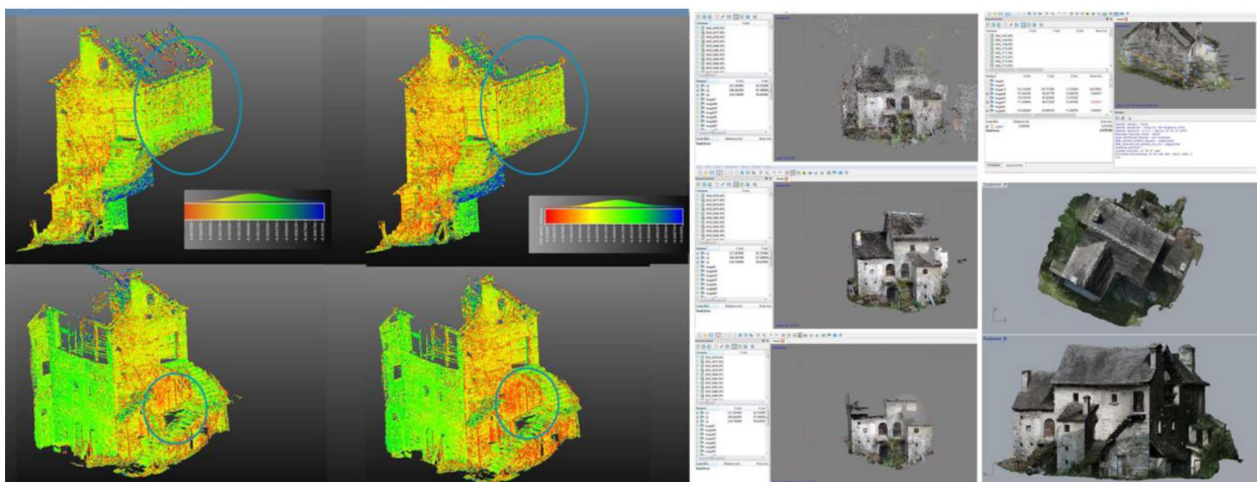
The described workflow has been revolutionized by the introduction of Structure from Motion (SfM) techniques, born from the merge of the photogrammetry and computer vision disciplines. It allows the reconstruction of three-dimensional models from two-dimensional image sequences that can be coupled with homologous points. SfM refers to the phenomenon whereby the human visual system recreates 3D structures from an object's or scene's projected 2D motion field. According to the structure from motion theorem, "the structure of four non-coplanar points can be recovered from three orthographic projections" [45]. The SfM allowed one to simplify and speed up the photogrammetric workflow because it permits automatic matching of features for internal and external camera calibration (bundle adjustment) and the construction of a dense point cloud (Multi-View Stereo algorithms) without manually reconstructing the artefacts profile. Of course, the basic photogrammetric concepts that are indispensable for consciously managing the survey, processing and quality (resolution and accuracy) of the outputs remain unchanged and are therefore introduced during the theory sessions.

During both the theoretical and practical activities, it is underlined that the choice of survey system and methodologies are strongly connected to the characteristics of the investigated object (size, shape, position, materials), the surrounding environment, the final purpose and the scale of graphic representation. Figure 4 depicts, by way of example, some types of final technical drawings (plans, sections and elevations) generated at the proper scale for the conservation project. Knowing how to choose the right technology and strategy according to the needs of the intervention is a skill that can only be developed with adequate training and direct experience with these issues. In fact, for mindful and successful digital documentation of cultural heritage, it is essential not only to be familiar with surveying methods and techniques and data management software but also to have well-defined aims. The objective of the survey enables you to plan it effectively, selecting the most appropriate system and measurement technique based on the object size, properties, surroundings and level of detail. The following management of acquired data and processed information is another critical topic that implies specific skills. The professionals must work with multi-source data and multi-format, e.g., raw digital data (range maps, laser scans and point clouds in general) and the resulting outputs (orthoimages, technical drawings, CAD models, mesh, etc.). The processing of terrestrial and/or aerial range- and image-based acquisitions produce three-dimensional models and orthophotos (Figure 5). These outputs and elaborations are then employed in the subsequent phases of identifying and mapping the materials and their conservation status. The students have to represent the recognized materials, the decay analysis and the methodology of interventions with

opportune technical language and graphics symbols (Figure 6). For example, in Italy, the NorMaL [46] is used in the context of cultural heritage as a normative reference for defining terms and codes for different forms of alteration and degradation visible to the naked eye of natural and artificial stone materials.

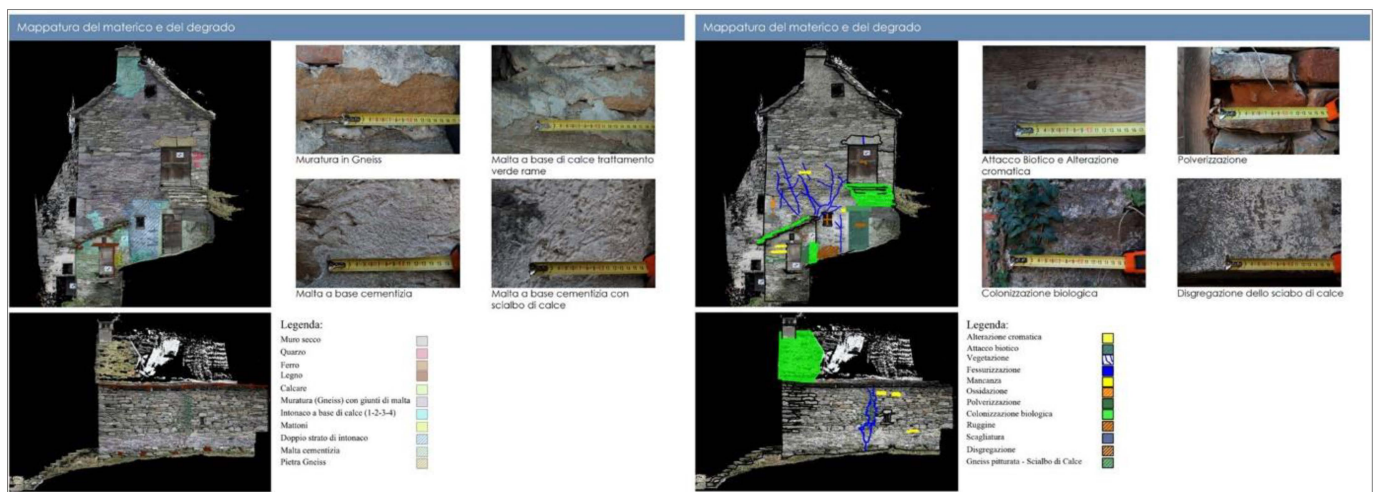


**Figure 4.** Final technical drawings (plans, sections and elevations) at the appropriate scales for the conservation project.



**Figure 5.** Three-dimensional models and orthophotos generated by data processing.





**Figure 6.** Materials and decay mapping.

### 2.3. Education and Learning

One of the didactic objectives is also to change the thinking and acting way to promote long-term prevention and treatment strategies instead of immediate benefit alone. Training, therefore, represents a fundamental and non-substitutable step. The necessary educational initiatives must be taken at all levels of training, and the appropriate professional figures must be trained to guarantee good results. The change in the figure of the cultural heritage professional must consist of an awareness of the value of heritage, accompanied by excellent competence on a practical and theoretical level.

Moreover, training of a more technical nature related to geomatics is always accompanied by site knowledge activities to sharpen sensitivity to the relationship with the asset to be surveyed and protected. Interventions involving cultural heritage also require careful historical, archaeological, architectural and interpretative analysis. Consequently, at least one day of the training course is typically dedicated to heritage awareness through a guided tour in close contact with the asset, the location and the context.

Therefore, the educational and training pathway must incorporate comprehension of the context in which the cultural legacy is situated. Consequently, the educational and training proposal cannot be repeated identically. The course must have a methodological and modular structure that identifies it and allows it to be adapted to the specific needs concerning the context features. Thus, although the hardware and software tools are in step with the times and although the case study has changed, the methodological structure of the training activities and the relationship between theory (20%) and practice (80%) have not changed, resulting in a successful and practical scheme.

These educational activities often lead to the rediscovery of so-called “minor” cultural heritage [47]. In such situations, it is essential to study and evaluate the relevance and role of the examined asset for local people, considering the need for its protection [48,49].

The opportunity for participants to study specific themes of personal interest, possibly relevant to their professional activities, is an engaging aspect of this course. The heterogeneity of the course participants made it possible, during each edition, to give space to wide-ranging topics and applications. Figures 7–9 show examples of the digital survey and modelling of bells, faces and tiny artefacts.

In this way, participants can acquire skills that can then be useful during professional activity. In practice, they are able to refine the use of tools and methods according to specific objectives, experimenting with different ways of processing data. Two aspects ensure the strength of this type of training activity. Firstly, lecturers and learners are in direct and close contact, even during practical activities, thus reducing the barriers between classical students and professors. Second, different lecturers are involved in these training courses, each with specific and in-depth didactic expertise and topics.

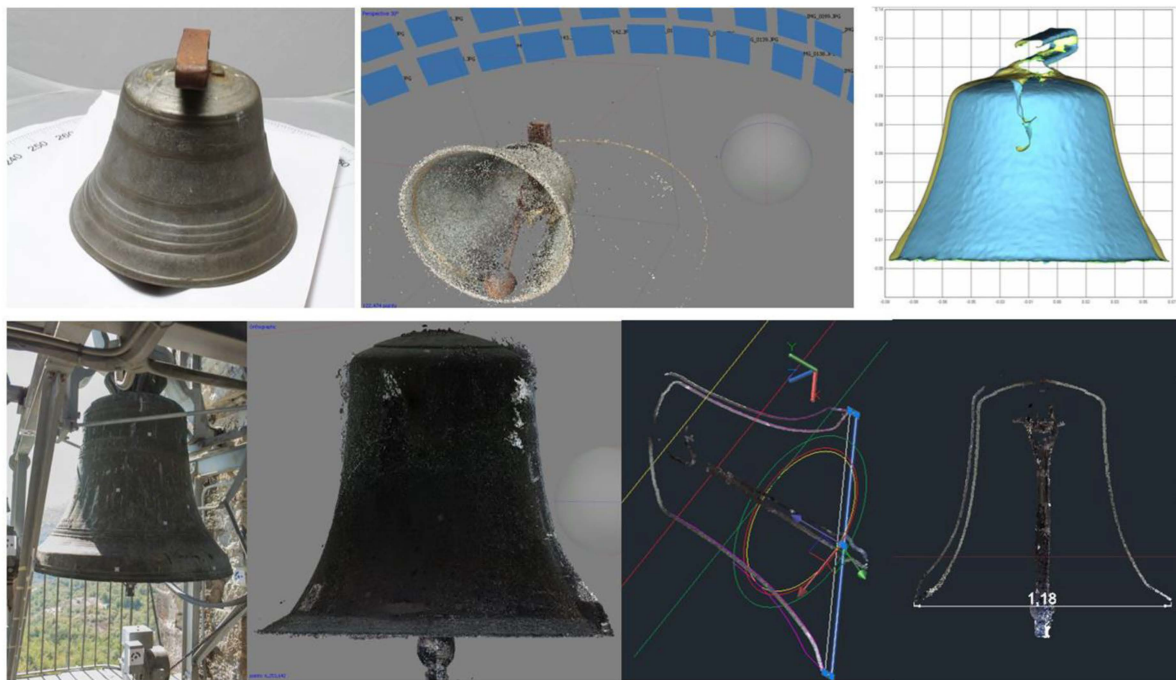


Figure 7. Bells digital survey modelling and metrological study.

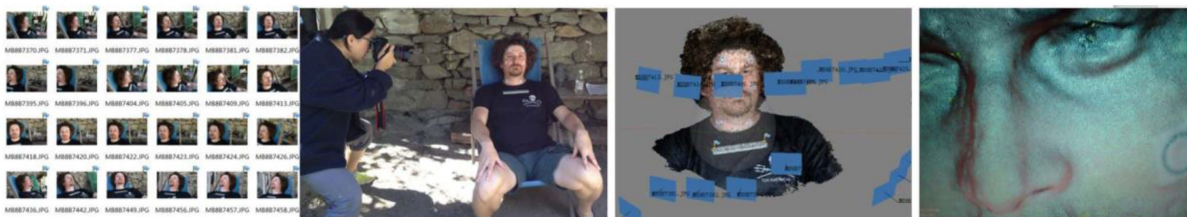


Figure 8. A photogrammetric specific application: face digital survey modelling, workflow.

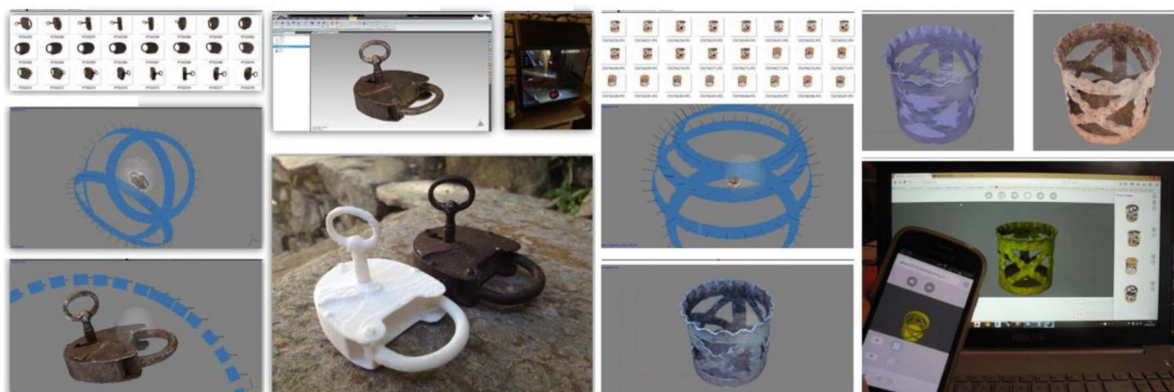


Figure 9. Tiny artefacts digitalization and modelling (details survey).

In general, the teaching staff consist of at least one expert in range-based techniques, one expert in image-based techniques, one expert in photography for cultural heritage, one expert in topography and one expert in conservation and restoration. Participants are divided into groups and work with each professor to complete a specific task, supported by tutors.

Teamwork is another characteristic of training courses since it compels participants to exchange ideas and perspectives. The different backgrounds and expertise of the participants result in a constant exchange of views, opinions, suggestions and information, which

enrich the individual training assets. For example, the group must define and discuss schedules and strategies for performing activities, such as how to divide the work.

#### 2.4. Student Evaluation and Legacy

Finally, consideration must also be given to how the skills and competencies acquired by course participants are assessed and certified. Participants of training courses and summer schools, which provide for the recognition of training credits, are asked to take a final test. Closed-ended questionnaires (true/false-type) were used as an instrument for verifying learning, assigning the same number of questions to each topic. An example of the kind of test and questions used to test participants' learning outcomes has been attached in Appendix C. At the end of the examination, the answers are presented and discussed in a group session. Finally, a further verification tool is a final presentation on the work carried out by each working group. The learning outcomes have always been very good, in our opinion, thanks to the "theory + practice" mode implemented. Moreover, participants must anonymously fill out a questionnaire to evaluate the teaching offered and suggest future improvements from their point of view. Appendix D presents a model of the educational offer evolution test used; instead, section "Discussion" reports some additional reflections based on the result of these two types of questionnaires submitted to the summer students. These two tests gave us feedback on both student learning and the effectiveness and satisfaction of the didactic approach.

For students, the training often continues after summer school with stage or thesis activities. This possibility increases the time available to deepen the covered topics, complete the work and supplement the knowledge acquired with additional skills. Figure 10 shows an example of a student activity carried out during the stage regarding artefacts surveying and 3D printing to design tactile museum routes for visually impaired or blind people.



**Figure 10.** Activities carried out during a student stage: artefacts surveying and 3D printing to design a tactile museum route for visually impaired or blind people.



### 3. Cultural Heritage Education: Primary and Secondary School

#### 3.1. Upper Secondary Education and Professional Paths

The relationship between school, innovation and access to culture represents the main strategic axis of Italian law 107/15, the so-called *Buona scuola* [6]. School is where the fundamentals are laid to full citizenship, at the foundation of which there is access to culture. The idea of combining training and cultural heritage aroused the interest of upper secondary schools. It was decided to structure the proposals so that the training activity corresponded to the guidelines contained in the school-to-work project Italian guide [50].

School-to-work is a system of education that allows students to combine classroom instruction with practical experience in a public or private institution. Since 2015, it has been mandatory for all high school students in Italy. The innovative school-to-work method helps consolidate the knowledge acquired at school and tests student aptitudes in the field through practical experience. These project activities enrich student training and guide their study and work path in the future, thanks to projects in line with their curriculum. Since 2019 the full name of the school-to-work method has been “Pathways of Transversal Skills and Orientation” (PCTO—*Percorsi per le Competenze Trasversali e l’Orientamento*) [51]. The upper secondary schools planned the professional training periods of their students based on specific agreements with other training institutions and business companies to facilitate their transition into the workforce (orientation days, meetings with companies and professionals, internships, field research, project work, etc.).

The great challenge of innovative teaching, also defined as “teaching by skills”, focuses on the performance of learning or what students do with their resources. Consequently, the so-called verification tests must detect the level of competence reached by the student, not only in terms of knowledge and skills, but also according to that plurality of dimensions, which allow them an original and functional re-elaboration of a given context/background. In this context, the cultural heritage, as a multidimensional and multidisciplinary system, is a crucial educational and training factor for the digital native generation, promotes a conscious relationship with the territory and offers the chance to actualize the interaction with cultural resources [52].

The knowledge and understanding of cultural heritage represent a fundamental contribution to the education of young students, promoting a mature and conscious relationship with their territory and its cultural resources [53].

Working on cultural heritage requires the involvement of many disciplinary fields, therefore allowing the possibility of actively involving schools with different curricula and taking advantage of the flexible structure of PCTO paths. The exercise of the right to study, with particular reference to upper secondary school students, also translates into taking advantage of cultural and educational activities in the area.

The experiences conducted during the COVID-19 pandemic were designed in a mixed-mode, remote and in-person approach, consistent with institutional arrangements of each school, within the constraints imposed by the health emergency.

The restrictions imposed by the COVID-19 emergency have pushed the rediscovery of spaces near schools, as well as other ways of providing and experiencing education. Indeed, within the PCTO (2019–2022) at the upper secondary school *Liceo Leopardi* (Lecco), in favor of the rediscovery and enhancement of the local cultural heritage and territorial identity, the theme chosen for an experimental didactic laboratory was the Monumental Complex of Laorca [54], near the school itself.

Moreover, during the quarantine, the on-site visit was replaced by the Virtual Tour (VT) web navigation of the site. In this manner, the participants were also able to become familiar with this digital tool. Figure 11 is a series of photographs shot during on-site and online didactic activities at the Monumental Complex of Laorca as part of the *Liceo Leopardi* PCTO. The Laorca complex VT was carried out as part of a Master’s thesis at the Politecnico di Milano [55]. Regarding the pilot project activated at the *Liceo “Leopardi”* (in collaboration with the Politecnico di Milano, Lecco Campus, the social promotion association LaorcaLAB [56] and the Municipality’s welfar social services), students participated

in the creation of multimedia content (images, photos, panoramas, videos and audio) that enriched the original/classical VT.



**Figure 11.** On-site and online didactic activities at the Monumental Complex of Laorca (Lecco) as part of the “Liceo Leopardi” PTCO.

The VT is an amazing immersive application, which even customers may easily operate. Through frontal lectures and laboratory experiences, the students learned the fundamentals of digital data acquisition techniques: artistic photography, light painting, panoramic photography, image stitching and image editing.

Practical photographic experiments were conducted in the classroom to stimulate and reinforce students’ understanding of the essential concepts covered in the theoretical lectures. The students in the classroom took tests to experiment with the concepts of depth of field and aperture, exposure times and light painting. Figure 12 depicts some photos taken during the training: from theory to practice, to stimulate student curiosity and individual interests and preferences.

Then, the participants in the PCTO activities used the collected data, both multimedia and non-media, to create an educational game for the primary and lower secondary school students and the members of the LaorcaLab cultural association. The didactic path consisted of 10 stages and was realized both in a version available online within the VT [57], helpful during quarantine periods, and in a printed version playable directly on-site (named “Detective a Laorca” *Enigmi e Misteri*).





Figure 12. Photography lessons, from understanding the basics to practicing them in the classroom.

Each stage of the game corresponds to a subject, tale and historical/architectural/natural aspect that fascinated the students during their on-site visits and online explorations. The students then studied and delved deeper into the selected topics, which they confirmed under the supervision of their teachers.

For the online version of the game path, three types of icons were added to the panoramic stations related to the chosen topics/quizzes. The first type of icon was to open a window with historical/cultural information relating to the single stage of the game. The second type instead linked to the instructions of the single path game. Finally, the third provided the solution. However, this last icon appeared in the panorama only after closing the game window. Figure 13 shows images of the VT with some stages of the game and the related three types of icons.



**Figure 13.** Images of the VT with some stages of the game designed by students.

The combination of educational activity and cultural heritage was an innovative and stimulating approach, even in the conditions of distance learning [58]. The experimental teaching activity was launched for the first time to offer new didactic methods during the pandemic; indeed, they were carried out both in the academic year 2020–21 but then also in 2021–22 and are already scheduled for next year.

### 3.2. Primary and Low-Level Secondary School

Communicating cultural heritage means making possible the process of recognizing and attributing value to material and immaterial traces we come across every day. Cultural heritage exists if it is recognized as such.

Cultural heritage can be communicated in different contexts and ways. Still, it is above all in the places where it is present that it is necessary to stimulate the direct and conscious relationship between the youngest citizens and cultural heritage [53]. At the primary and secondary school levels, it is necessary to formulate effective content and modes of communication without losing scientific rigor and appropriateness. The proposal educational plan has to be calibrated from time to time according to the specific needs of the addressee. Without forgetting that recent advances in communication technologies have enriched the tools available for teaching, giving a powerful boost to education development. Today, all students experience both traditional didactics (teacher lessons, lectures) and active didactics (laboratory experiences, trips on the territory, elaboration of texts and graphs and construction of multimedia products).

Active teaching makes the experience captivating and can be adapted according to the subject and the objectives to be achieved. Moreover, the number and kind of tools available today also allow for adapting teaching methods according to the age, knowledge and skills already possessed by students. Cultural heritage is undoubtedly an excellent training ground for creating opportunities and situations where students can experiment with different education and learning strategies, employing both traditional methods (writing, drawing, oral narration) and new technologies (multimedia products, digital storytelling,



social media) [59–62]. The primary and lower secondary school classes (*Armando Diaz* and *Don Giovanni Ticozzi—Lecco*) participated in various excursions and guided tours to discover the heritage of their territory, including the Monumental Complex of Laorca. For the youngest primary school students, the initial experience was a series of class trips to discover the places and the territory, followed by a reflection/activity functional to interpret/memorize what had been seen/visited. Figure 14 shows some photos of the activities held post-lock down.



**Figure 14.** The pictures refer to some of the activities held post lockdown within primary and lower secondary schools (Spring/summer 2021).

Typical didactic activities include freehand drawing, text writing and story inventing. A part of the experience is also linked with “working together,” i.e., active discussion with professors and classmates regarding the concept of cultural heritage.

The younger scholar can also use the printed version of the path game “*Detective a Laorca*” *Enigmi e Misteri* developed by high school students as a tool for knowledge and learning (Figure 15). A video showing these activities carried out during the COVID and post-COVID period was produced and presented at the ICOMOS International Day for Monuments and Sites, with the approval of all those involved in the project.

In 1982, ICOMOS established 18 April as the International Day of Monuments and Sites, followed by its adoption by UNESCO at the 22nd General Conference. Every year, on this occasion, ICOMOS proposes a theme for the activities organized by its members, national and international scientific committees, partners and anyone who wants to participate in this celebration. For International Monuments and Sites Day 2021, ICOMOS encouraged sharing experiences, obviously following instructions from local and national authorities to ensure the safety of participants during the COVID-19 pandemic [63].





**Figure 15.** Some pictures summarize activities with primary school scholars, using the printed version of the path game “*Detective a Laorca*” *Enigmi e Misteri* designed by high school students (May, June 2022).

The event title on 18 April 2021 was “Complex Pasts: Diverse Futures”, and the topic was focused on “Conservation of cultural heritage requires critical examination of the past, as much as its practice demands provision for the future”. Debates on the omission and erasure of certain narratives and the privileging of stories over others have come to a head in recent years. Addressing contested histories hence involves complex conversations, and avoiding biased views and interpretations of the past.

The World Heritage Convention (1972) states: “deterioration or disappearance of any item of the cultural or natural heritage constitutes a harmful impoverishment of the heritage of all the nations of the world; however, imbalances in recognition, interpretation and, ultimately, conservation of various cultural manifestations continue to exist. ICOMOS wishes to engage in promoting new discourses and different and nuanced approaches to existing historical narratives, to support inclusive and diverse points of view” [64]. The problematic situation linked to the pandemic has made it possible to rediscover proximity heritage. The class trips have been moments of strong aggregation for all, students and teachers, and permit all to study and deepen the issues related to the history of the place and the cultural heritage that characterizes it. The images of the documentary video [65,66] summarize the moments of study, research and discovery of the many groups of students, teachers and citizens involved in the projects, demonstrating that cultural heritage is very powerful ‘by means of’ creating new paths of knowledge, friendship and inclusion (Figure 16).





**Figure 16.** Frames extracted from the documentary video ‘Legami di Comunità’ (Community ties) realized for ICOMOS IDMS 2021, ICOMOS Italia and CIPA Heritage Documentation. The images are accompanied by keywords that synthesize activities. The keywords summarize the sense attributed to Cultural Heritage: ‘Education, knowledge, respect, friendship: our cultural heritage’.

#### 4. Discussion

Regarding the activities conducted with university students and professionals as part of the summer schools, two questionnaires were carried out at the end of the courses, one for the learning evaluation (Appendix C, described in Section 2.4) and one for the teaching valuation (Appendix D).

The questions for the education offer evaluations (the standard range are poor/insufficient/good/excellent) that cover various aspects and are useful to obtain a general satisfaction index of the activities.

Participants are asked to evaluate various aspects of the course (training contests; teaching methodology and techniques; target achievement; teaching material; logistic;



professional improvement; overall satisfaction), and the results are handed over to both the course lecturers and the university secretariat.

The compiling of the questionnaires, over more than 10 years, showed general satisfaction with the theory + practice mode in particular. The average response for 90% was “Good”.

The last part of the questionnaire included open-ended questions. In particular, with regards to the last question, “Suggestions, indications or requests you think appropriate to mention”, a more prolonged course duration was often requested. The course lasts 10 days, and increasing the time would allow it to be attended by students but not by professionals. However, the presence of professionals with practical demands from the work world and a diversified background was a strength for us. For this reason, the duration has never been changed. With the positive feedback regarding the evaluation of learning and teaching, we believe that the formula “theory + practice” was effective and appreciated. As far as high school students are concerned, the ‘testing methods’ must be specified for the PCTO project validity. The project sheet indicates which teachers and tutors are the contact persons, the description of the activities and objectives broken down into skills and which sector experts are involved (universities, companies, associations). At the end of the planned hours, the skills acquired are assessed through preparing a paper, a written test and/or an oral discussion.

In the case of PCTO Projects, the proposal of projects that had geographical proximity to the school, thus proposing the discovery of cultural heritage in the vicinity, was particularly appreciated.

With primary and secondary schoolchildren, there is no real form of verification.

Several notions were identified with the teachers that need to be understood at the end of the activities. In particular, reference can be made to learning the names and locations of places visited in addition to learning and consolidating specific terminology to describe cultural heritage elements. Starting with a map, the younger students learn to follow a path, and the compilation of the games involves the inclusion of words referring to specific architectural elements. In general, the experiences have been positive, and what we would like to do in the near future is to ‘stabilize’ these educational moments with a focus on cultural heritage elements close to schools. This purpose is to promote, along with learning about specific topics, a civic sense and care for cultural heritage, starting with the one closest to us.

## 5. Conclusions

Despite the continuing limitations imposed by the pandemic and post-pandemic emergency, Europe’s recovery phase has been initiated through the NextGenerationEU [66]. In Italy, guidelines and investments have been outlined in line with the National Recovery and Resilience Plan (PNRR—*Piano Nazionale di Ripresa e Resilienza*) [67] to overcome the crisis. As far as heritage education is concerned, the intention is to identify/provide different lines of direction:

- on the initiatives to be undertaken;
- on the sharing of existing system actions at the national level;
- on confirming the relevance of cooperation;

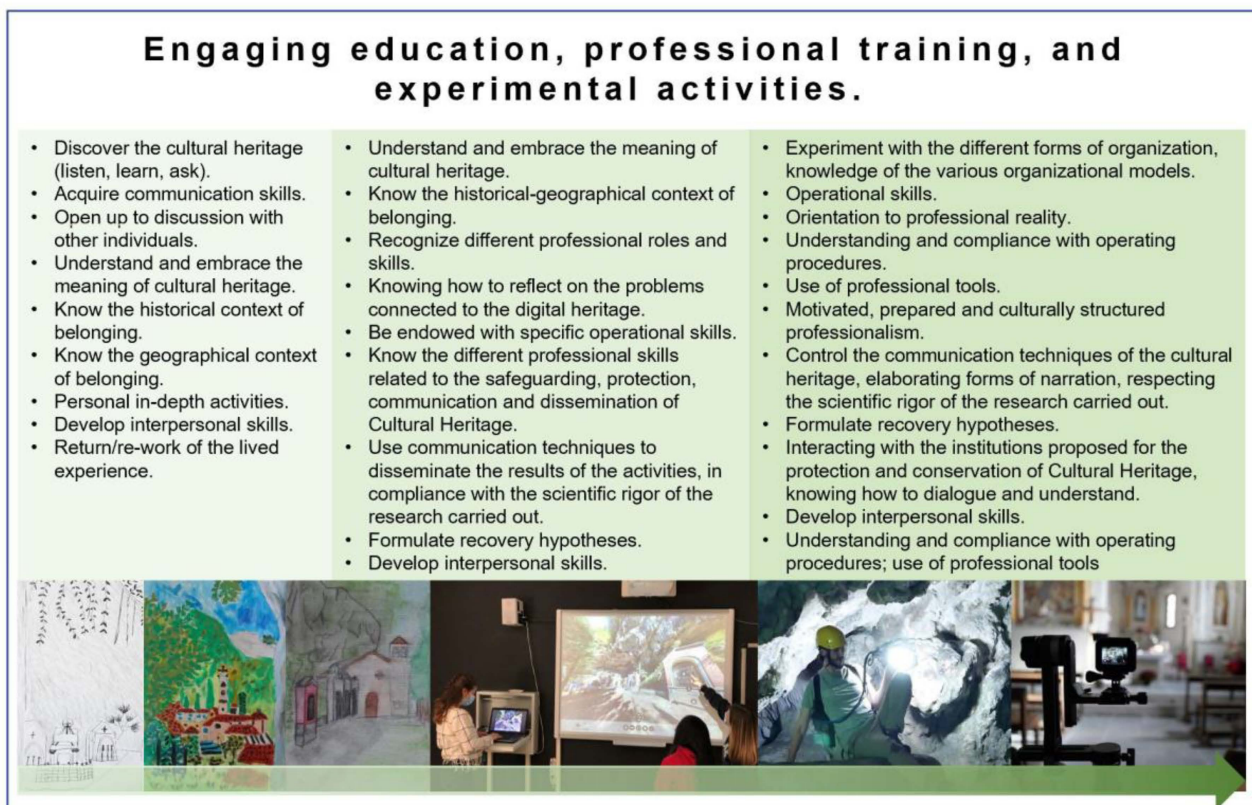
One can support the educational services network by adapting national planning activities and identifying specific actions to contribute effectively to cultural heritage protection and enhancement. Italy has defined its specific priorities in PNRR: a complex of interventions divided into six missions, in which culture plays a relevant role in the development and renewal of the country. The third component of the first mission, Digitalisation, Innovation, Competitiveness, Culture and Tourism, is dedicated to culture. In this context, a specific measure dedicated to cultural heritage (M1C3.1) has been outlined, with investments aimed both at fostering the creation of digital cultural heritage through infrastructures and services (Investment 1.1) and at improving accessibility (Invest-

ment 1.2) by overcoming architectural, cultural and cognitive barriers and through specific training actions.

Additional actions are aimed at enhancing the attractiveness of villages, the protection and enhancement of the rural architecture and landscape, the valorization of historic parks and gardens and the improvement of energy efficiency in cultural venues and seismic safety. Therefore, there are many areas in which heritage education can and should make a relevant contribution, as outlined in the National Plan for Heritage Education [5]. Projects, such as those illustrated in Sections 2.1–2.3 aim to promote actions to enhance experiences and workshops in order to develop skills aimed at the knowledge, protection and enhancement of cultural heritage.

The opportunities offered by digitization and innovation (NextGenerationEU strategic axis) are achieved through the progressive dissemination of specific transversal skills and represent a necessary condition for the future sustainability of the cultural heritage sectors. Therefore, all training activities need to incorporate strategic learning on more updated hardware and software tools.

Moreover, the request for specific skills related to cultural heritage justifies and necessitates the development of a didactic proposal adaptable to training from primary school through adulthood, identifying specific qualifications. Therefore, a continuous training strategy consisting of educational activities designed for younger students (such as guided tours, laboratory experiences and discussions) and specific actions for university students and professionals (such as updating courses, in-depth classes theoretical and practical, Digi Skills training and summer schools on a specific focus) turned out to be the most effective (Figure 17).



**Figure 17.** Summary of the progressive increase in skills/competencies/awareness during the school career and beyond.

This way, the teaching and learning modes adapt to the education level and corresponding professional figures. Experiences conducted in recent years through summer schools, training courses and PCTOs seem to propose an adequate solution to the needs of cultural heritage education. One key success factor is undoubtedly the on-field training, a technical-operational tool indispensable for training heritage professionals and proposing an innovative approach for the youngest students. These experiences should not be isolated episodes in the learning process but should progressively become an integral part of the educational activity, starting from the early years of school life.

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## Appendix A

In Italy, for some typical figures in the sector (such as art historians, archaeologists, archivists and librarians), there is a diploma obtained in the Schools of specialization for the protection, management and valorization of Cultural Heritage.

The training of restorers is traditionally entrusted to the ICR (*Istituto Superiore del Restauro e della Conservazione*) and OPD (*Opificio Pietre Dure di Firenze*) schools or other regionally recognized schools rather than to universities [68,69]. Regulated profession refers to the activity, or the set of activities, whose exercise is permitted only following registration in orders or colleges or registers, records and lists kept by public administrations or bodies.

Among the cultural heritage professionals identified by Article 9a of the Heritage and Landscape Code [70], the Restorer of Cultural Property and the Restoration Technician of Cultural Property fall into the regulated professions category.

For these professionals, non-inclusion in the lists precludes the exercise of the profession. For the other professions, qualifications are acquired after a specific training course supplemented by professional experience. These professions may also be exercised by those who are not registered on the lists, provided they can prove that they meet the requirements [24].

## Appendix B

Since 2010, the 3DSurvey Group of the Politecnico di Milano has organized different summer schools in collaboration with lecturers from the Politecnico di Milano, other universities and national and international research centers.

The 2010–2011–2012–2013 editions are titled *Conoscere per tutelare. Riuso e potenziamento dell'area archeologica e del Museo delle Navi romane del lago di Nemi*, Departments BEST and DPA of Politecnico di Milano, with course heads Proff. N. Lombardini and C. Achille [71]. The archaeological area under study is located in the Municipality of Nemi, Rome, near the lake of the same name [43].

From 2011, the 3DSurvey Laboratory in collaboration with the Canova Association, initiated an annual summer school program entitled “Laboratory of Places, Ghesc and surroundings: History, survey and evolution Laboratory of Places” [72]. Canova Association is an international non-profit organization founded in 2001 in the medieval village of Canova, Oira di Crevoladossola, Italy [73]. The principal goal of the Canova Association is the preservation and enhancement of rural medieval stone architecture. Art and architecture intertwine, stimulating research and debate, revolving around the conviction that old stone construction can offer adequate if not superior models in our search today for sustainable human dwelling solutions. The continuing insensitivity to this fact is resulting in indiscriminate demolition and renovation, forever cancelling the precious heritage of rural stone architecture in Italy and Europe. The intention and goal of the Canova Association are to reverse this tendency, carrying out activities aimed at sensitizing both the public and private sector. The field schools take place in the suggestive medieval abandoned village of Ghesc. It is a village consisting of seven stone houses across the river from Canova. Ghesc is the ideal stage for what we like to call the “Infinite Laboratory”, and it is the playing field of the International Canova Field School program.

The “Laboratory of Places” 2018–2019 editions [74] took place at Sacro Monte Calvario di Domodossola, one of the nine Sacri Monti (Holy Mountains) of Northern Italy [75]. The nine Sacri Monti of Northern Italy are groups of chapels and other buildings erected between the end of the 15th and the beginning of the 18th century, dedicated to different aspects of the Christian faith. They offer a wonderful example of integration between architecture and the surrounding landscape. They also host an important artistic heritage of wall paintings and statues. This is the motivation by UNESCO, as it registered the “Sacri Monti of Piedmont and Lombardy” on the World Heritage List in 2003 [76].

The primary goal of the summer schools is to create a collaborative experience involving students, teachers and members of the association and local community to contribute to the documentation of Cultural Patrimony, thereby actively participating in its rediscovery and preservation.

The courses were structured in three parts: preparatory theoretical lectures, an on-site survey campaign and processing of the acquired data. The aim is to enable the participants to know how to use instruments and methods after adequate theoretical preparation and then to be able to critically process the surveyed data.

Briefly, the activities concerned (i) a topographic survey; (ii) a close-range photogrammetric survey; (iii) a laser-scanner survey; (iv) processing/validation of acquired data; (v) analysis of materials and their state of preservation; (vi) creating capabilities for the ‘virtual’ design of interventions on the basis of collected data (starting from plans, sections and 3D models); (vii) use of digital techniques for the enhancement, including tourism, of the site.

These courses were suspended during the period of the health emergency that did not allow them to run smoothly. It was deemed preferable to suspend the activities and not offer them in an online version. It is our belief that, along with study, one must put into practice what one has learnt directly in the field, and certainly surveying and representation activities are among those that require ‘direct’ contact with Cultural Heritage.




## Appendix C

<b>Summer School evaluation test</b>		
1- The laser scanning is an optical passive measuring technique.	YES	NO
2- In the image 1: the max achievable resolution is 3.2mm at 20m distance.	YES	NO
3- The laser scanner range depends on material albedo.	YES	NO
4- The accuracy in distance is the scan resolution.	YES	NO
5- The accuracy in distance decrease with the object distance.	YES	NO
6- Laser scanner point clouds need to be scaled before using them.	YES	NO
7- TOF laser scanners are optimal for the digitization of small archaeological artifacts in indoor environments.	YES	NO
8- Laser scanners can have some problems on mirrors or reflective surfaces	YES	NO
9- Reflectance value depends on object distance.	YES	NO
10- The registration between laser scanner point clouds can be done using targets.	YES	NO
11- TOF scanners are able to acquire up to 1 million points per second.	YES	NO
12- A laser scanner can also be placed and used on a flying airplane or on a moving car	YES	NO
13- A laser scan you can get measurements in the real scale.	YES	NO
14- To register/align 2 laser scanner point clouds you need at least 2 points.	YES	NO
15- Terrestrial laser scanning is possible to extract drawings at 1:1 representation scale.	YES	NO
16- Photogrammetry allows you to make three-dimensional measurements	YES	NO
17- Orthophotos can only be measured correctly in the parts that correspond to the reference plane.	YES	NO
18- Orthophotos Allow you to measure three-dimensional coordinates	YES	NO
19- The GCPs can be measured from the scanner data	YES	NO
20- The GSD depends on the distance camera-object	YES	NO
21- The GSD is the pixel footprint on the object	YES	NO
22- Calibration is necessary to calculate the internal orientation parameters	YES	NO
23- Photogrammetry is a passive optical measuring technique	YES	NO
24- The radial distortion depends on the lens characteristic	YES	NO

**Figure A1.** An example of a questionnaire carried out at the end of the courses, for the learning evaluation.



## Appendix D



## PARTICIPANT EVALUATION QUESTIONNAIRE

COURSE TITLE: \_\_\_\_\_

Milan,

*Please mark your choice with an X.*

This questionnaire aims at gathering your evaluation about the course mentioned above. We guarantee the confidentiality of the gathered data, that will be used for a potential enhancement of future training initiatives. We thank you for your collaboration.

- 1) TRAINING CONTENTS  
(in reference to the examined topics in terms of completeness and coherence with regards to the foreseen targets):

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

- 2) TEACHING METHODOLOGY AND TECHNIQUES (Lessons, exercises, discussions ...):

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

- 3) TARGET ACHIEVEMENT  
(in reference to the comparison of acquired skills with the ones foreseen from the beginning):

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

- 4) TEACHING MATERIAL

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

- 5) LOGISTICS (classroom, teaching instruments both individual and collective):

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

- 6) PROFESSIONAL IMPROVEMENT  
(in reference to the improvement of one's professional growth and of the quality of work):

NOT FORESEEN	POOR	INSUFFICIENT	SUFFICIENT	GOOD
--------------	------	--------------	------------	------

Figure A2. Cont.

7) OVERALL SATISFACTION

POOR	INSUFFICIENT	SUFFICIENT	GOOD
------	--------------	------------	------

**DIDACTICS EVALUATION**

Legend  
(The following evaluation scale applies to each question)  
1  poor 2  insufficient 3  sufficient 4  good

Teacher	Interest in the subject	Clarity	Relationship between teacher/participant
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4

Which one of the discussed topics did you find the most interesting?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Do you think it appropriate to delve further into the discussed topics?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Suggestions, indications, or requests you think appropriate to mention

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Figure A2.** A questionnaire carried out at the end of the courses, for the teaching quality valuation.

## Notes

- <sup>1</sup> The authors refer to the “collaborative teaching” definition of R. Robinson and R. Schaible as “any academic experience in which two professors work together in designing and teaching a course that itself uses group learning techniques” [37].

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