Pedagogy and Engagement in At-Risk World Heritage Initiatives

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Summary. Cultural heritage constitutes humanity's identity, marking the civilisation and progress of peoples in time all over our world. Protection of cultural heritage and its diversity has been parallelised to the protection of biodiversity. Yet, cultural heritage is constantly at risk, either by natural causes or by human intervention. The Centre for Cyber-Archaeology and Sustainability at UCSD has undertaken research and public outreach programmes worldwide concerning at-risk cultural heritage. Specifically for such initiatives in Greece it formed a stable collaboration with the University of the Aegean and the Athena Research Centre. Recognising that the informed citizens, and more specifically the informed students, are key factors towards an effective preservation of World Heritage, this paper represents an account of those initiatives from the perspective of the pedagogy and engagement. In addition, this paper introduces to the World Heritage and the threats that it faces all over the world and presents a number of significant initiatives taken by major worldwide organisations such as UNESCO.

Key words: Cyber-Archaeology, Pedagogy, Cultural Heritage, at-risk Heritage

1 Introduction

According to the Human Rights Office of the High Commissioner of the United Nations the Universal Declaration of Human Rights consists of six cross-cutting themes[1], one of which is Culture. Culture is recognised as a central and precious ingredient of peoples' identity. The 1948 Universal Declaration of Human Rights

[1] United Nations, Universal Declaration of Human Rights - In six cross-cutting themes, http://www.ohchr.org/EN/UDHR/Pages/CrossCuttingThemes.aspx

in Article 27[2] specifically underlines that *everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits*, which also implies that no-one has the right to eradicate a culture or impose their own culture upon others. In addition, the UNESCO Universal Declaration on Cultural Diversity[3], which was unanimously adopted just after the terrible 9/11 events in an attempt to affirm that the cross-cultural dialog is the best guarantee for peace and prosperity, takes a further step by boldly identifying that "as a source of exchange, innovation and creativity, cultural diversity is as necessary for humankind as biodiversity is for nature". Heritage is the legacy of the past, an account of the Culture that preceded. UNESCO while seeking to encourage the protection of heritage of outstanding value to humanity, adopted in 1972 an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage[4], or simple the World Heritage Convention.

Through the *World Heritage Centre*[5], UNESCO publishes important reports on World Heritage its preservation and its connection with development. One such recent report[6] presents satellite data from disasters in World Heritage sites, either of natural or of human origins. This report is the result of a collaboration of UNESCO with UNITAR/UNOSAT, in which satellite imagery is being used to monitor and assess damage to World Heritage sites. Apart from the chapter on Nepal, in which a natural disaster put the Kathmandu Valley World Heritage property under threat, all other chapters involve, unfortunately, human imposed disasters, including: (a) Syria, where the ongoing conflict since 2011 severely damaged important monuments; (b) Iraq, where since 2003 its heritage (one of the oldest in the world) has been at risk of destruction and looting; (c) Yemen, where since 2015 cultural heritage has been put at risk by another ongoing conflict.

Fig. 1 shows a screenshot of the site around the Temple of Ba'al (or Bel) in Palmyra, Syria, as presented (left) in Google Maps, in which the Temple is still clearly visible and (right) in Apple Maps, in which there is no indication of the Temple. Both images where captured the same day, but clearly, the one on the left is either outdated or intentionally left showing a previous snapshot of the site. A similar picture appears in Fig. 2, which shows the site around the Palace of Ashurnasirpal II in Nimrud, Iraq, before and after its destruction. To complete the picture, Fig. 3 depicts the result of the destructive force of nature recorded

[2] United Nations, Universal Declaration of Human Rights, `http://www.un.org/en/universal-declaration-human-rights/`,`http://www.un-documents.net/a3r217a.htm`

[3] UNESCO, Universal Declaration on Cultural Diversity, `http://www.un-documents.net/udcd.htm`

[4] UNESCO, Convention Concerning the Protection of the World Cultural and Natural Heritage, `http://whc.unesco.org/en/conventiontext/`

[5] World Heritage Centre @ `http://whc.unesco.org`

[6] UNESCO, (2016) Satellite-Based Damage Assessment of Cultural Heritage Sites - 2015 Summary Report of Iraq, Nepal, Syria & Yemen, available online at `http://whc.unesco.org/en/activities/890/`

Fig. 1. The Temple of Ba'al (Bel) in Palmyra, Syria, (left) before and (right) after its destruction

Fig. 2. The Palace of Ashurnasirpal II in Nimrud, Iraq, (left) before and (right) after its destruction

Fig. 3. The Bhaktapur Durbar Square Monument Zone in Kathmandu, Nepal, (left) showing the Fasidega Temple (circled) and (right) showing the same region after an earthquake destroyed the Temple

in the Bhaktapur Durbar Square Monument Zone in Kathmandu, Nepal, where the Fasidega Temple (in the red circle) is missing in the image to the right (the left image is taken from Apple Maps whereas the right image is a screenshot from Google Maps).

From a general perspective, cultural heritage is constantly at-risk; either by natural causes or by human interventions, the precious heritage of humanity will always be endangered, and so individual or coordinated actions to preserve it are actions that preserve the very human identity. These actions can be *proactive* if they rely on the promotion of cultural education and in some cases of training in special skills and of active individual and organisational participation. As stated in the 81st Annual Meeting of the Society for American Archaeology in Orlando, Florida, in April 2016, *"the biggest ally and advocate for the preservation and protection of archaeological materials is an informed public."*[7] In this paper, we review various cases and experiences in using engaging pedagogical approaches towards cultural education and especially towards the preservation of World Heritage.

2 Pedagogy in the preservation of World Heritage

Since the value of World Heritage is recognised by all major authorities, the academia and the informed citizens worldwide, as situations put it constantly at risk there is, apparently, a need to strengthen its preservation activities and actions; these actions beginning with dissemination and education, moving on to applications of modern technology and the involvement of all citizens, are key-actions towards the sought strengthening.

Pedagogy originates from the greek *Παιδαγωγός* (pedagogue), with an etymology suggested by *παῖς* + *ἀγωγός*, meaning the servant to accompany the children to school. Nowadays, it has the meaning of the scientist of pedagogy, or the parent or teacher positively affecting children's education. The greek *Παιδαγωγία* (pedagogia) became *pédagogie* in French, from which *pedagogy* emerged, with a meaning that relates to the art, science, or profession of teaching (Merriam-Webster dictionary), or the method and practice of teaching, especially as an academic subject or theoretical concept (Oxford dictionary).

The presentation of actions and pedagogy in the preservation of World Heritage that follows is a selection of initiatives by major organisations and our institutions. In additions, some very indicative independent initiative are also listed for completeness.

[7] See "Public Engagement and Education: Developing Heritage Stewardship" @ `https://goo.gl/OIpTv1` for a list of interesting articles in the subject.

2.1 Policies and public archaeology initiatives

During Euromed conference in Nicosia, Cyprus, in October 2016, *Europeana Space*[8] organised a special panel entitled "Reusing Digital Cultural Heritage: Boosting Education, Audience Engagement, Business Creation" including the most notable EU projects and initiatives dealing with digitised cultural heritage, which focused on the realisation that digital cultural data should be re-used to leverage the wealth of digital resources to improve citizens' participation, access and enjoyment of cultural heritage and also to unlock the business potential that lies within it[9].

The *European Agenda for Culture*[10] defines multiple roles for culture, in education and intellectual creativity to employment, innovation and politics, and specifically underlines as its specific objective the *"promoting the Unesco Convention on the Protection and Promotion of the Diversity of Cultural Expressions and contributing to its implementation at international level"*. This Agenda resulted in the Work Plan for Culture (2015-2018)[11] to implement those objectives in the form of cross-disciplinary research and innovation projects. This resulted in the launching of a number of calls for proposals under the H2020 programme (especially in the "Reflective Societies: Cultural Heritage and European Identities" topic), aiming at innovations in the integration of culture and education as a proactive approach towards informed citizens, empowered researchers and scholars and engaged professionals.

The Society for American Archaeology (SAA) has already recognised the importance of educating the public on cultural heritage and runs the "Archaeology for the Public" program[12], which targets both K-12 education and (even more importantly) training of the educators. The program provides educators with background information and activities that would engage students in archaeology, including resources on archaeology, fieldwork opportunities, contacts, study kits, publications and more. SAA proclaims to redefine or better to abstain from defining the term "public archaeology", viewing it as something much more than just exposing the public to the products of archaeological research. SAA bases this proclamation on a realisation that "public archaeology" ("community archaeology" in the UK and elsewhere) includes a lot more than informing the

[8] Europeana Space, is a Best Practice Network that aims to create new opportunities for employment and economic growth within the creative industries sector, based on Europe's rich digital cultural resources.

[9] Report on "Reusing Digital Cultural Heritage: Boosting Education, Audience Engagement, Business Creation" @ `https://goo.gl/rQb5ro` (digitalmeetsculture.net)

[10] Resolution of the Council on a European Agenda for Culture (2007/C 287/01) of 16 November 2007, @ `http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007G1129(01)&from=EN`

[11] Conclusions of the Council and of the Representatives of the Governments of the Member States, meeting within the Council, on a Work Plan for Culture (2015-2018), @ `http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XG1223(02)&from=EN`

[12] SAA, Archaeology for the Public, `http://www.saa.org/publicftp/PUBLIC/home/home.html`

Fig. 4. Photos during public archaeology educational excavation work[15]

public about archaeological findings and interpretations, in a number of areas of specialisation including museums, education, descendant involvement, ethics, cultural tourism, and there are a number of different definitions about it[13]. SAA summarises[14] their goals in:

- stimulating public interest in archaeology
- raising awareness on the importance of cultural resources and advocate for their preservation
- educating the public on the processes and importance of archaeological research
- advocating for the ethical practice of archaeology
- aiding in creating public policy regarding archaeological excavation and preservation
- connecting people to their heritage

By recognising the tremendous positive power of education, their basic tools to accomplish these goals are site tours, exhibitions and demonstrations, recreation of past life-ways and instruction in excavation techniques by a trained professional. Fig. 4 shows people engaged in public archaeology projects.

2.2 Crowdsourcing initiatives

Recognising the great potential of people's engagement and involvement in heritage preservation, the United Nations Institute for Training and Research (UNITAR) and specifically the UNITAR's Operational Satellite Applications Programme (UNOSAT) created UN-ASIGN Crowd[16], a free application offered to

[13] SAA provides an indicative list of definitions in their portal @ `http://www.saa.org/publicftp/PUBLIC/forArchaeologists/outreach_PAis.html`

[14] Gessica Barry, Public Archaeology, available @ `https://www.bloomu.edu/documents/cola/PublicArchaeology.pdf`

[15] Photos taken from `https://goo.gl/pd1Ecn` (dayofarchaeology.com)

[16] UN Adaptive System for Image Communication over Global Networks (UN-ASIGN) crowdsourcing initiative, `https://www.unitar.org/unosat/un-asign-crowd-source-photos-mobile-app`, `https://asign.cern.ch`

the humanitarian community to facilitate the collection of photos, assessments, and geo-located text messaging in the field. The system was specifically designed to work over low bandwidth connections and to present photos in real time. UNOSAT has access to all photos and can share those relevant with the UN Office for the Coordination of Humanitarian Affairs (UN OCHA) and other coordination entities, and thus contribute to prompt coordinated actions. Practice has already shown that this system is regularly being used in major emergency responses, including Syria, Iraq, Haiti, Pakistan, Nigeria, Thailand.

Technically, this system is based on the use of Geographic Information Systems (GIS) and satellite imagery and offers users and contributors the option to upload content and their report through a specifically developed mobile app for all mobile platforms[17]. In addition, a web portal[18] and live web-maps[19] are provided to enable viewing and interaction with data uploaded by contributors in this crowdsourcing-based project. The huge amounts of data are hosted at CERN, with which UNOSAT has made a strategic partnership, to get advantage of the significant computing capacity and storage. UN-ASIGN recognises the multi-dimensionality of the issue and relies on a core team consisting of satellite imagery analysts, GIS experts, IT and database engineers, UN field workers and expert trainers. A typical usage case study usually presented for this system is the case of the Earthquake in Nepal, in 2015, which is shown in Fig. 5 and can be accessed online[20].

Apparently, this initiative may have a significant impact on putting the World Heritage on stage and on raising the peoples' awareness, by engaging them and including them in a process of participation and contribution towards the preservation of cultural heritage. The 'vehicle' is again technology and the numerous possibilities that mobile applications offer, nowadays. By simplifying the access to the content as well as the active participation, UNs pedagogical approach is clearly based on the creation of informed citizens.

In line with the initiatives of the United Nations, the TerraWatchers project has launched as a crowdsourcing system aiming at monitoring at-risk World Heritage and identifying locations of specific incidents. The project started as an initiative of a small group of people and then got support by the Centre for Cyber-Archaeology and Sustainability (CCAS) at the University of Cali-

[17] UN-ASIGN for iOS is available @ `https://itunes.apple.com/us/app/un-asign/id507125097`, UN-ASIGN for Android is available @ `https://play.google.com/store/apps/details?id=ansur.asign.un` and UN-ASIGN for Windows Mobile is available @ `http://www.windowsphone.com/en-us/store/app/un-asign/91da7d7f-2461-45cd-ad1b-f332d2c1e63b`

[18] UN-ASIGN web portal @ `https://asign.cern.ch`

[19] UN-ASIGN crowd viewer @ `https://unosat.maps.arcgis.com/apps/webappviewer/`; Various UN-ASIGN live maps also @ `https://unosatgis.cern.ch`; There is also a map of the latest photos (non-moderated) @ `https://goo.gl/iZmTvE`

[20] Operational WebMap of the 2015 Nepal Earthquake @ `https://unosat.maps.arcgis.com/apps/webappviewer/index.html?id=b9f9da798f364cd6a6e68fc20f5475eb`

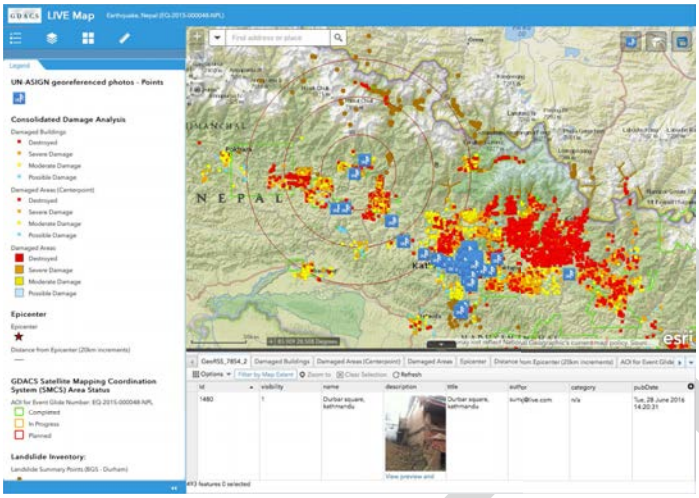

Fig. 5. A screenshot of the WebMap of the 2015 Nepal earthquake

fornia San Diego (UCSD). The TerraWatchers[21], aims to engage people into assessing types of damage on satellite imagery, by providing web-based, crowd-sourced satellite image monitoring and over-watch tools, relying basically on Google Maps technology. The workflow at TerraWatchers is based on the notion of 'missions', which are initiated by individuals or organisations with a special interest in World Heritage damage assessment in consultation with the development team, and are either open for contributions or require a special user permission to be accessed. There is, for example, the mission entitled "The Impact of Military Activity and Looting on Archaeological Sites in Lebanon, Syria, and Iraq", initiated in April 2015, in which 48 users have already contributed 1738 observations (to the date of writing this text), of which:

- 35 users observed 273 instances of "Looting"
- 20 users observed 62 instances of "Air Defence"
- 33 users observed 303 instances of "Revetment/Berm"
- 17 users observed 72 instances of "Military Hardware"
- 25 users observed 101 instances "Trench"
- 16 users observed 73 instances of "Bunker/Shelter"
- 13 users observed 30 instances of "Other Structure"
- 12 users observed 36 instances of "Impact Crater"
- 9 users observed 37 instances of "Other"

The map created by all those reported instances is shown in Fig. 6, which is apparently an impressive result of crowdsourced efforts. Of these observations, more than 70% are *confirmed instances*. The confirmation is a tedious task that

[21] TerraWatchers: Crowd sourced satellite image analysis, online @ `http://terrawatchers.org`

Fig. 6. TerraWatchers map of instances in the mission titled as "The Impact of Military Activity and Looting on Archaeological Sites in Lebanon, Syria, and Iraq"

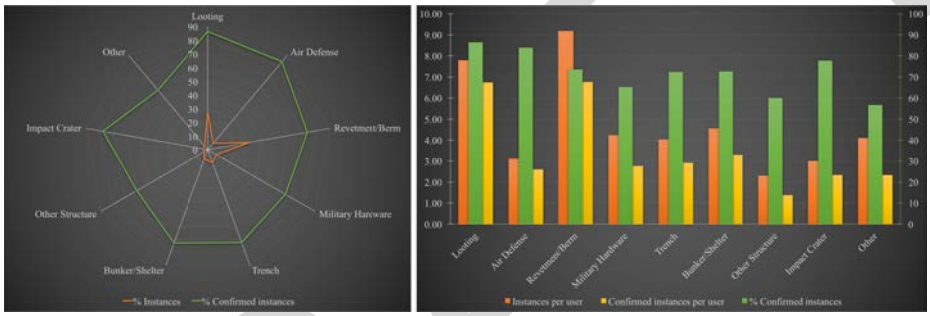

Fig. 7. TerraWatchers map of instances in the mission titled as "The Impact of Military Activity and Looting on Archaeological Sites in Lebanon, Syria, and Iraq"

Fig. 8. Example of "Looting" including from left to right: a true positive match, a false positive (in drier regions the sparse, mottled vegetation can resemble looting) and a false negative (with time looting pits become less distinct)

is manually handled by GIS and satellite image interpretation experts. Two charts depicting those data are shown in Fig. 7. The chart on the right is a typical bar chart showing the number of instances and the number of confirmed instances reported per user per case (orange and yellow), and the percentage of

confirmed instances per case. The chart on the right is a radar chart that is used to highlight a comparison of the instances reported and the confirmation rate for each of the cases being monitored. Apparently, the confirmation ratio is high in almost all cases (except the 'other' cases). The chart also shows that most observations relate to 'Looting' and 'Revetment/Berm' instances.

The workflow at TerraWatchers is heavily based on the training of contributors so that their observations add value to the initiative and the data being created are of high quality. The pedagogical approach is twofold: (a) on one hand it includes the organisation of specific training workshops, in which the TerraWatchers' experts and mission administrators train the users on how to use the system and most importantly on how to analyse satellite imagery and recognise important features; (b) on the other hand it includes Web-based presentations of typical and clearly distinctive examples for true-positive, false-positive, or even false-negative instances, for each of the cases being monitored. For example, Fig. 8 shows some of the images presented to the users to let them understand the fine differences that they should take into account so that the true-positive recognition rate is maximised. It should be emphasised that in a recent publication of the group (Savage, Johnson & Levy, 2017) it was reported that even after a three-hour training sessions in a live workshop that included students with no prior experience in satellite image analysis, improved the true-positive rate 5 to 6 times in comparison to the results attained for the same mission by users that did not attend a training session and relied only to the Web-based material.

2.3 Engagement of archaeology students and professionals

One very successful instrument in the engagement and training of students and interested professionals in the preservation of cultural heritage, is the organisation of international summers schools in World Heritage sites, such as the *Digital Technologies and Fieldwork in Cultural Heritage and Museums* (DIGARCH) summer school[22], which is organised by the University of the Aegean, Greece, in collaboration with the Levantine Archaeology Laboratory, UCSD, USA and the Athena Research Centre, Greece. The summer school takes place in Delphi, Greece, one of the most noted archaeological sites in the world, and one of the important sites included in the World Heritage List of UNESCO[23]. This summer school has already taken place in Delphi for the years 2015 and 2016, and attracted more than 30 students and cultural heritage professionals each year. DIGARCH aims to inform and train students and professionals with the state-of-the-art technological and methodological approaches for the digitisation, study and dissemination of cultural heritage, immersing them, at the same time, into the sacred landscape of Delphi and into the invigorating experience of summertime Greece. It includes theoretic presentations and on-site and laboratory

[22] The DIGARCH2016 summer school website is @ `https://digarch2016.pns.aegean.gr`

[23] Archeological site of Delphi in the World Heritage List @ `http://whc.unesco.org/en/list/393/`

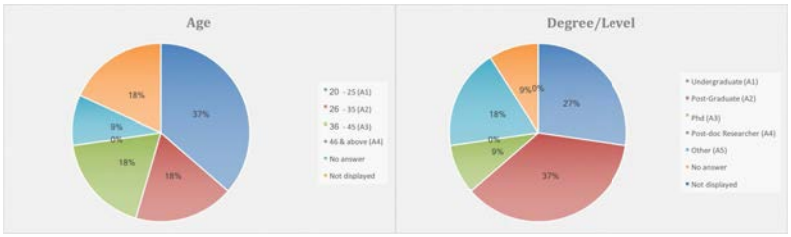

Fig. 9. Profile of the participants of the DIGARCH2015 summer school

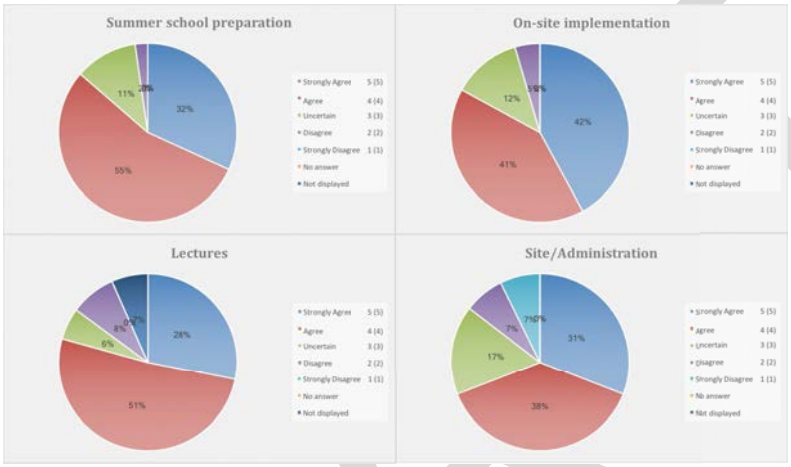

Fig. 10. Statistics from the students feedback for the DIGARCH2015 summer school

practice by recognised experts in all the fields. Some of the statistics of the DIGARCH2015 are shown in Figs. 9-10.

Specifically, Fig. 9 presents a brief profile of the participants by their age range and background. Obviously the majority of the participants are in the 'productive' age range 20-35, a significantly positive fact, since these students will become well-informed professionals. Even those who were already professionals reported a positive influence of this summer school as documented by the feedback statistics. Fig. 10 shows the statistics representing the students feedback after the completion of the summer school. The statistics show a success rate of more than 80% (if one sums-up the positive responses – 'strongly agree' and 'agree'). What was most important and encouraging was the fact that all of the participants in the questionnaires, a complete 100%, reported they would definitely recommend this summer school to colleagues and friends, although many of them reported different reasons for choosing to participate. Apparently the live, in person, communication, the hands-on approach and the high-end technology support, constitute the main pedagogical approach in this summer school, which was designed to bring together experts, modern methods and tools with students and professionals. This is considered one of the most suc-

Fig. 11. Mycenaean site at Kastrouli, Greece

Fig. 12. Data and representations produced during the Kastrouli field school

cessful approaches and is typically being applied in many settings and domains throughout the world.

Another successful instrument in the engagement and training of students and professionals in cultural heritage is the organisation of field schools. Field schools involve intense on-site training in real-life conditions that are being guided and supported by highly experienced experts. One such a case is the *Kastrouli excavation field school*, which took place at the Mycenaean site of Kastrouli near Delphi, Greece (Fig. 11), and it was organised as an extension of the 2016 DIGARCH summer school specifically for University of California San Diego and University of the Aegean students. The fieldwork included digging and sample processing, geophysical prospection, cyber-archaeology, and also local guided museum and monastery visits. The field work was successful and important discoveries were made during the excavation and data processing (Fig. 12).

Another important excavation field school is that of Karabournaki, in Thessaloniki, Greece, which is an excavation with a long history that is run by the Aristotle University of Thessaloniki (Fig. 13). The site hosts an ancient settlement with storerooms and houses, with big quantities of pottery local and imported (Attic, Corinthian, East Greek etc.), dated 8th-5th centuries B.C. The field school collaborated with the Athena Research Centre for a number of in-

Fig. 13. The archaeological site at Karabournaki, Greece

novations. This collaboration begun as an initiative towards a complete digital excavation during the beginning of the 21st century. The first approach was to create digital infrastructures to move the recording of all data to the digital domain and to train young archaeologists in their use Tsiafakis, Evangelidis, Pavlidis, Tsirliganis & Chamzas (2004); Tsiafakis, Tsirliganis, Pavlidis, Evangelidis & Chamzas (2004); Tsirliganis, Pavlidis, Koutsoudis, Papadopoulou, Tsompanopoulos, Stavroglou, Loukou & Chamzas (2004). Lately this collaboration escalated in more technical aspects and a new training session took place to train archaeology students in new methods for on-site fast and accurate image-based 3D digitisation. The training focused on Structure from Motion 3D scanning, which is a very successful and efficient method for the optical recording of cultural heritage. The pedagogical approach was based on the simplification of the technical presentation and adaptation of the teaching material to the specific audience and the hands-on practice.

2.4 Education, schools and engagement in cultural heritage

Throughout the world, a number of pedagogical initiatives take place, using various approaches as their starting point. For example, in Nivín, at the north coast of Peru, there is an agricultural community that happens to be surrounded by massive archaeological sites dating back to 200 BC. In this community, there is a school that is also a museum, in which archaeological resources of the area are integrated into the school curriculum to teach students about the importance of their cultural heritage. This is a remarkable example of the incorporation of cultural heritage into education and vice-versa. Fig. 14 shows a characteristic view inside the Nivín school and museum.

Another such of a recent (2015-20016) example comes from North-eastern Greece, a small town called Pentapolis (near the city of Serres). On the walls of the high school building of Pentapolis, one may find the exhibition of a large part of the works of a significant local painter, Vasilios Terzis. The originality of the use of school space as an exhibition stands together with its major push for cultural education and the association of education with culture, which represents

[24] Photos taken from `https://goo.gl/tzY2Ow` (rcnnolly.wordpress.com)

Fig. 14. A view of the Nivin school and museum[24]

a strong trend in the 21st century Europe. This trend aims at an integration of culture and education in the day to day educational practice, while promoting cultural education, improving the overall cultural level and helping to strengthen the European cultural identity.

The originality in this school-exhibition became a motivation for further research of methods and ways of integrating and strengthening the ties between culture and education. Since the natural catalyst that may facilitate this connection is no other than technology, the school collaborated with the Athena Research Centre to integrate dynamic web-based virtual museum technologies into their exhibition. The outcome was a virtual exhibition based on modern first/third person gaming technologies that provided a digital copy of the school itself, in which teachers and students could create their virtual exhibitions on demand and post them on the Web for everyone to visit. The dynamic technology that was used was an adaptation of the technology of the 'Dynamus' virtual exhibition framework created at the Athena Research Centre (Kiourt, Koutsoudis, Arnaoutoglou, Petsa, Markantonatou & Pavlidis, 2015a,b; Petsa, Kiourt, Koutsoudis, Arnaoutoglou, Markantonatou & Pavlidis, 2015).

Through the activities, in which many students in the Pentapolis high school have been involved, they learnt to respect art and culture and were exposed and has real practice on how to preserve and disseminate it. Fig. 15(left) shows photos of part of two corridors in the school with the exhibited paintings, whereas on the right there is a screenshot of the exterior of the virtual school (bottom) and two screenshots of virtual exhibitions in the interior (top).

Furthermore, the teachers and students created a web portal to promote their school-museum[25], and put their efforts in creating dissemination content[26], in addition to their web-based virtual museum[27]. The team participated in a student's entrepreneurship competition in their municipality and won the first

[25] The Pentapolis school-museum project @ `http://pinakothiki-gel-pentapolis.weebly.com`

[26] The Pentapolis school-museum project on YouTube @ `https://youtu.be/U0OFOJmjEnk` and @ `https://youtu.be/p9EClat_OE4`

[27] The Pentapolis school virtual museum @ `http://dynamus.ipet.gr/school/` (lite version also available @ `http://dynamus.ipet.gr/school/light/`)

Fig. 15. The Pentapolis high school-gallery; (left) photos of the interior; (right) screenshots from the virtual environment and exhibitions

place, and they also participated in an informatics conference and in the 2016 Thessaloniki Trade Fair.

Apparently, one may recognise a number of pedagogical approaches at work in the project: (a) cultural education and integration of culture in learning, (b) extensive team work and collaboration, (c) motivation with participation in major events and competitions, (d) exploitation of gamification factors and the appeal of gaming environments to children, (e) testing of ideas in real-life environments, and more. This endeavour definitely created a new "culture" and formulated a fresh and healthy view on art and heritage to those involved.

In another relevant project in Greece, project 'Synthesis', was driven by the same vision of merging cultural heritage with the educational practice. The inspiration for 'Synthesis' came from the works of exceptional thinkers and artists of the 20th century Greece that connected the international artistic movements with Hellenism and were either the precursors or kept pace with the *Generation of 1930* in Greece[28]. A benchmark of this era is the work of the important Greek painter *Spyros Papaloukas*, whose works are preserved and displayed in the "B&M Theocharakis Foundation for the Fine Arts and Music" (ThF)[29]. The work of Papaloukas connects with the Acropolis-Philopappou highly respected architectural projects of architect *Dimitris Pikionis* and the artworks of *Hadjikyriakos-Gikas* and *Parthenis*, with whom Spyros Papaloukas had close spiritual relationship and drew inspiration from, along with the Antiquity, Byzantium, the modern art in Europe and the Greek folk art. ThF teamed up with the Athena Research Centre to design and implement 'Synthesis', building upon the strong legacy of those works, envisioning to create educational content

[28] The Generation of the 1930s, marking a century after the Greek independence, is considered of high importance as it successfully placed Greece in a prominent position in European art. See "The Emergence of Modern Greek Painting, 1830-1930 - From the Bank of Greece collection" @ `http://www.bankofgreece.gr/BogDocumentEn/period_1830-1930.pdf`

[29] A presentation of Spyros Papaloukas life is provided by ThF on Google Arts & Cultures @ `https://goo.gl/Jf5N6r`; a large collection of his works are exhibited @ `https://goo.gl/SWtkH5` (google.com/culturalinstitute)

for the usual, everyday educational classroom practice and to develop a set of innovations to strengthen the cultural education and the students awareness of their cultural heritage and of its universal value. The project resulted a set of applications including (a) a VR game and a mobile app based on the architectural heritage of Acropolis-Philopappou and the works of Papaloukas, (b) a dynamic virtual museum for educational use, and (c) a set of complete courses in physics, chemistry, geometry, geography and french language based entirely on the works of art of Papaloukas that are still compliant with the Greek national educational programme[30].

Apparently, in this case, as in the previously discussed cases, there is also a strong element of technological involvement and gamification to fascinate the young and engage those involved in education to further exploit the cultural wealth that has already been available online after more than a decade of digitisation projects in cultural heritage. Synthesis' target is double: (a) on one hand it is to inform teachers and encourage them to use cultural heritage in their everyday practice and expose themselves and their students in its positive influence; (b) on the other hand it is to engage students to accept culture and heritage in their lives by using them in their school projects and their free time, either by playing the educational games, creating their own virtual exhibitions or by using the material created for their courses that significantly draws on cultural heritage.

Apart from the organisation of international events and initiatives, there are a number of information, education and training activities that can be undertaken. Among them, there are training workshops, open-day events, targeted seminars, and more.

One of these activities that are expected to have a significant impact to young students are the open-days and demonstrations. CCAS recently hosted a Cyber-Archaeology tour of the Qualcomm Institute (QI) for the La Jolla Country Day School (LJCDS). Both the Director of the Qualcomm Institute and the Director of CCAS, along with researchers, students and staff shared cyber-archaeology tools and visualisations with over 150 9th grade students from LJCDS. The 9th graders had the opportunity to experience at-risk cultural heritage sites and objects from around the world using VR headsets and large-scale interactive immersive environments. Fig. 16 shows some snapshots of the visit.

After the conclusion of the event, the students and the teachers that participated were asked to provide feedback on many aspects of their visit and experience, so that some preliminary conclusion could be drawn for the pedagogical and engagement aspects. Fig. 17 shows a radar chart of the overall average ratings for all sections of feedback that were asked. Although this chart alone points out some important results, some more charts clarify even more what the students gained and were engaged by and what had a little impact or was irrelevant to them. Figs. 18-19 highlight a significant aspect to be taken into account when engaging young students; that is the 'artificial' technology-culture

[30] The applications are available in the Web portal of Synthesis @ `http://synthesis.thf.gr/portal/applications-en/`

Fig. 16. Photos from the 2017 La Jolla Country Day School visit to CCAS/UCSD; from top-left: the visitors and the organisers; CCAS Director Prof. Levy talks about "at-risk cultural heritage"; visit in the VR WAVE; visit in the VR CAVE

gap, driven by the general positive trend towards easy technology consumption and the serious lack of a strong cultural education. The students in the event were mainly amazed by the technologies and high-tech venue rather than the actual content. Nevertheless, it can be noted that the gain in awareness regarding the cultural aspect, although lower than the one regarding technology, was still high (even though gained within two hours) and gives a positive incentive for the organisation of more such events. The lack of cultural education and awareness becomes even more apparent by the students' responses to career-related questions as shown in Fig. 20, where the poor ratings show that history and culture are among the least favourite and exciting courses at school. This fact highlights that raising cultural awareness could be much harder than is usually considered. As there is a lack in cultural education and a negative mentality towards history since the school years, implementing engagement programs in cultural heritage and especially in at-risk heritage should be carefully and thoroughly designed, planned, and delivered.

In addition, as CCAS recognises that image-based 3D reconstruction methods are gaining significant attention due to their success in recording the geometric characteristics and the colour appearance of cultural heritage objects while still being easy to use, reach out to students and teachers, from high school to the university, and organise workshops, seminars and hands-on training with a twofold purpose: (a) to train them in using these really powerful techniques and tools and (b) to instil the significance of cultural heritage in them and to infuse and

Fig. 17. Average ratings regarding all sections of feedback asked

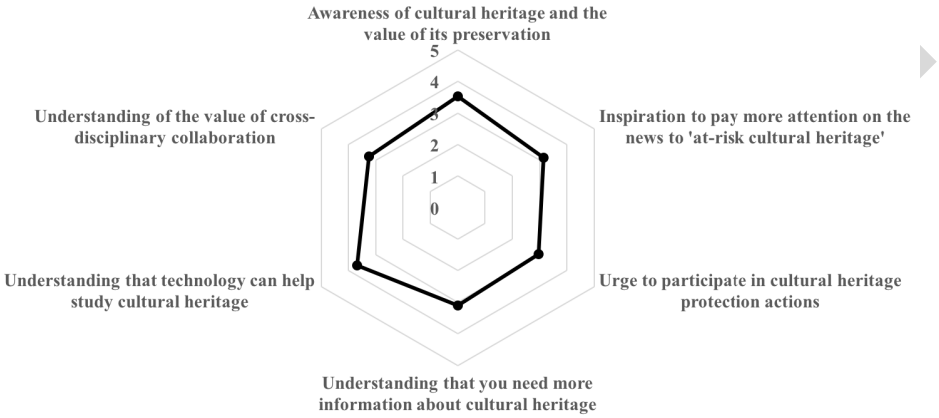

Fig. 18. Average ratings within the 'gain' section that correspond to cultural heritage related feedback

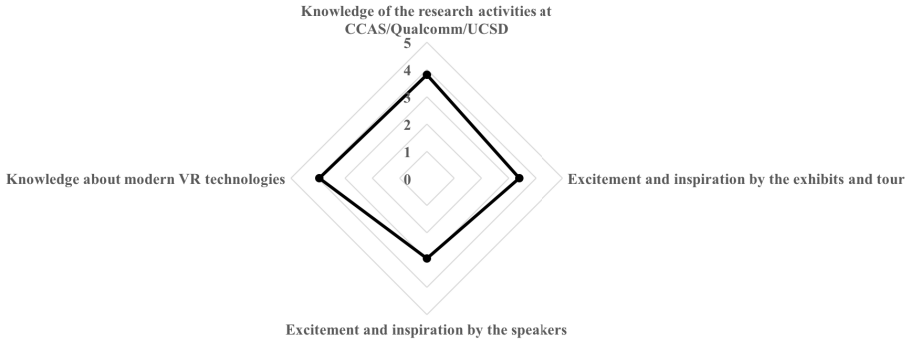

Fig. 19. Average ratings within the 'gain' section that correspond to technology related feedback

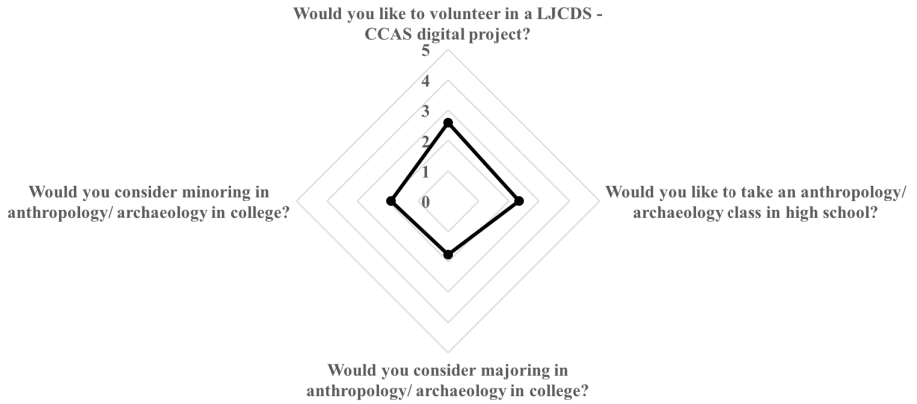

Fig. 20. Average ratings regarding career-related feedback

Fig. 21. Snapshot from an image-based 3D reconstruction hands-on seminar

inspire them with an urge to act and participate in preservation actions. Such a seminar took place recently at UCSD (see Fig. 21) with participants from a high school, including students and teachers interested in how to get involved in world heritage preservation. Actually, practice has shown that these small-scale seminars and hands-on workshops may have a great impact in raising awareness and excitement of people in cultural heritage and some of the cool ways to preserve it.

3 Conclusions

Protection of World Heritage is an action of a deep humanitarian meaning. Major organisations all over the world have recognised this officially since many years ago and have already initiated actions to protect cultural heritage using various measures, policies, strategies and engagement plans. One effective instrument towards this goal is education and training, because it constitutes a strong proactive measure.

Various pedagogical approaches have been used to support such initiatives, including information sharing, participation in events, workshops, seminars, summer schools and field schools, extensive team work, collaboration and crowdsourcing, motivation with participation in major events and competitions, adoption of gamification and edutainment approaches and cultural education and integration of culture in learning environments. All those approaches carefully 'packaged' under the general concept of heritage protection and the specific topic in each case has already produced positive outcomes and raised the public awareness and the students' or experts' knowledge.

Inevitably, World Heritage will always be at risk. Even if all human imposed threats are contained, there will still be a fight against nature and time. Thus the initiatives for engagement in cultural heritage will not and should not cease. What has started by recognised organisations and individuals long ago still goes on and is being augmented with new methods and means. This paper was an account of some important initiatives from the perspective of the pedagogy and engagement.

4 Acknowledgements

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