
Cross-Disciplinary Pedagogies: Education on Heritage and Climate Change in Europe

1.1. Introduction

Cultural heritage in Europe, as well as worldwide, is threatened by climate change, which impairs its integrity and threatens its values. In addition to amplifying existing vulnerabilities and threats, climate change creates new risks to cultural heritage (Masson-Delmotte et al. 2021). Cultural heritage includes not only physical artifacts, but also the knowledge and skills gained through human practices, representations and experiences related to the objects and spaces recognized by communities as cultural heritage (UNESCO n.d.). Cultural heritage assets such as historical buildings, archeological sites and monuments, as well as their contents and collections, are legacy items from our past that lend a sense of place, identity and esthetic well-being to local communities (Sesana et al. 2021). Accordingly, the value of cultural heritage extends beyond its physical presence. People connect with places through their cultural heritage. It is a part of people's identities and inherent in almost every aspect of their life. As a result, it fosters a sense of belonging, promotes social inclusion and brings individuals together to collaborate more effectively. Thus, cultural heritage can be used to raise awareness about climate change and the need for climate action. Heritage may be impacted profoundly by climate change. However, it can also be a source of creativity, innovation and knowledge that can inspire and guide transitions to low-carbon, climate-resilient futures (Potts 2021, p. 6). This dual approach to climate change is promoted by the International Council

on Monuments and Sites (ICOMOS), which seeks to both address the risks climate change poses to cultural heritage, and promote heritage as a source of resilience and a resource for climate action (ICOMOS n.d.).

The role of architecture in reducing climate change effects (transition to zero-emission, energy-efficient and resilient buildings) is crucial. Over the past decade, climate change issues have become increasingly relevant to architectural design, urban planning, heritage studies and relevant disciplines. The Architects' Council of Europe (ACE) has urged architects to become more prominent in climate adaptation. ACE promotes a holistic approach to the built environment that serves all stakeholders economically, socially, environmentally and culturally (ACE 2021). Knowledge, expertise and experience from different fields and disciplines must be integrated when addressing climate change and embracing heritage as a resource and driver for sustainable development. This situation requires a focus on heritage and climate change in architectural education. This study focuses on the built environment, defining human-made environments, which also indicates cultural heritage that includes monuments, groups of buildings, sites and cultural landscapes, which are "combined works of nature and of man" (UNESCO 2011).

1.2. Climate change and heritage education

Climate change effects are well known worldwide, but research and quantification of their impacts on cultural heritage are still limited. To manage cultural heritage at risk, it is essential to implement effective strategies at all levels, from government policies to field practice. This requires awareness of climate change action, skilled human resources and capacity building. Professionals with solid skills in sustainable design and resilience are needed to develop and apply mitigation and adaptation measures. Therefore, it is critical to apply, update and develop professionals' skills continuously. In this regard, education and climate change are becoming more relevant and intertwined. Climate change's effects on heritage must be an integral part of architectural education. The curricula in architecture schools must emphasize the built heritage's vulnerability to climate change and the heritage's role in developing mitigation and adaptation strategies.

There is a complex relationship between climate change and cultural heritage (science, economics, society, politics, morals and ethics). This research shows a disparity between research, education and practice. To overcome this disparity, a multidisciplinary and holistic approach is needed in research, education and practice. Additionally, it is necessary to use innovative learning methods such as information and communication technology (ICT)-based learning processes in heritage and climate change education.

The Education for Climate-Resilient European Heritage Architecture (e-CREHA) project addresses the gaps. It aims to constitute the knowledge between education and research recommended by the 2018 European Union (EU) modernization agenda. The project's objective is to foster cooperation between research and education, theory and professional practice to enhance our understanding of how cultural heritage and design can contribute to climate change. The project aims to train and educate the next generation of tutors, researchers and professionals to help create a climate-resilient European cultural heritage. Multi-disciplinary experts and students from different European Higher Education Institutions (HEIs) have collaborated to formulate an innovative e-learning course and methodology focusing on developing climate resilience for European cultural heritage. The course focuses on resilient architectural heritage and climate change, and adopts an innovative approach and new interpretations of the content and methods. It is designed for graduate students in built environment-related programs to expand their intellectual resources and provide them with a new set of skills. The course includes modules with lectures, quizzes/games, video clips, assignments and students' virtual forum(s). Four main concepts are covered in the course:

RESILIENCE (built heritage and resilient concepts): The term “resilience” is defined by the Intergovernmental Panel on Climate Change (Mach et al. 2014, p. 127):

The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.

IMPACT (built heritage and impact of climate change): The IPCC Special Report on Climate Change and Land (van Diemen 2019, p. 815) defines the term “impact”:

The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability. Impacts generally refer to effects on lives; livelihoods; health and well-being; ecosystems and species; economic, social, and cultural assets; services (including ecosystem services); and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial.

VULNERABILITY (heritage as a resource for climate change): The IPCC SRCCL (van Diemen 2019, p. 826) explains “vulnerability”:

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

ADAPTATION (resilient heritage solutions): The IPCC SRCCL (van Diemen 2019, p. 804) defines “adaptation”:

In *human systems*, the process of adjustment to actual or expected *climate* and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

The report “Cross-disciplinary Pedagogies” (CDP), as the first intellectual output of the e-CREHA project, attempts to understand the current state of the art on how heritage in architectural education is responding to climate change. This research relies on the research and analysis of current interdisciplinary learning/teaching methods and approaches in different categories related to cultural heritage and climate change.

1.3. Research and analysis

Implementation of the e-CREHA e-learning course is based on a blended learning approach and setting up a new/experimental course. CDP aimed to specify and assess current approaches, interpretations and mediums in cross-disciplinary studies addressing heritage and climate change. In that framework, an Excel form was created for partners to list relevant courses and collect data on their content and methods. All partners filled in this table¹ by searching architecture/built environment schools and related academic institutions in their network. They also used search engines (Google, Bing and Baidu), Web of Science, Scopus and online learning platforms to search the Massive Open Online Course (MOOC) between February and August 2021.

¹ The research includes a list of current courses, games, documentaries and, in addition, climate governance, and the role of plans and policies. This chapter summarizes the results for courses. For the results of the other categories, please see the O1 CDP report (<https://www.ecreha.org/research>).

A convenient sampling based on geographic specialization was applied, including the methods/tools adopted in consortium countries, starting from their home countries which are most accessible to the partners. In the data collection phase, the limitations were the language barrier, the inaccessibility of related information, lack of information, or out-of-date online data about educational programs on the websites. For the qualitative analysis, in some cases, the nature of the data was not descriptive in terms of the contents and methods that they used².

The research results include 37 courses offered by institutions in nine different countries³. As a first analysis, we looked at course distribution by country, institution and year. It reveals that there is a greater interest/awareness/study of climate change and built heritage in The Netherlands and France than in other partner countries (Figure 1.1).

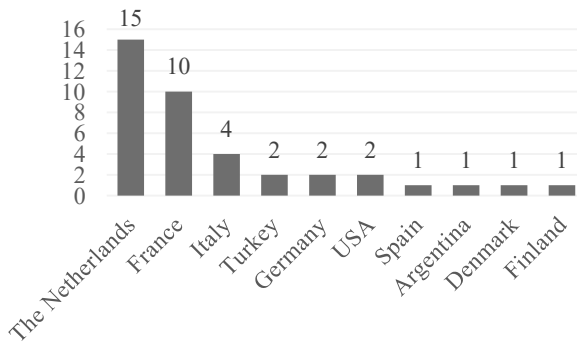


Figure 1.1. *Distribution of courses by country*

There has been an increase in the number of courses since 2017 (Figure 1.2). The reason may be that the impact of climate change has become more severe and threatening over the years. An increase in the number of courses coincides with the increasing international policies on climate change. In line with the Paris Agreement

2 For more info about the research (data, tables, graphs and more), please see the O1 CDP report (<https://www.ecreha.org/research>).

3 In addition to these courses, we reached two master programs, “Climate-adapted Construction and Operation” at BTU Cottbus (Germany) and “Radical Sustainable Architecture” at Aarhus School of Architecture (Denmark), and three other design courses: “Nationaal Centrum Duurzaamheid”, “De Eeuw van de Amateur-Wildcard Studio-focus on vernacular architecture” and “Weerstudio” by Academie Rotterdam (RAvB, The Netherlands). They are not included in the content analysis presented in Table 1.1, since we did not have sufficient information about their contents.

and the Sustainable Development Goals (SDGs), Europe has committed to cutting greenhouse gas emissions and transforming its economy and society in a zero-emission direction. Consequently, capacity-building efforts have made the built environment and environmental systems more resilient. Academies and institutes have begun to develop courses addressing issues associated with climate change.

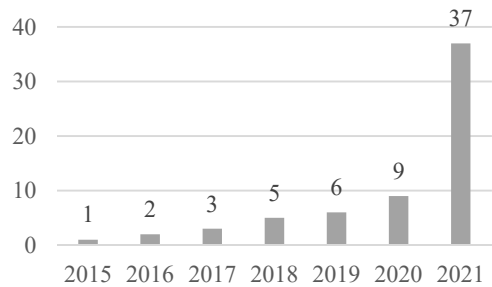


Figure 1.2. *Number of courses by year*

As part of our study, we also examined course types, contents and target groups, as well as learning environments, methods and tutors’ expertise areas. The courses vary in terms of their scopes, objectives, target groups, concepts, duration, pedagogical methods and learning environments. CDP shows that most courses are designed by HEIs (Figure 1.3). Regarding their target groups, the courses can roughly be classified as summer schools, MOOCs and undergraduate and graduate courses. Summer Schools are short-term events aimed at a broader audience than students (Figure 1.4). Regarding target groups, climate change and built heritage are generally considered graduate-level topics.

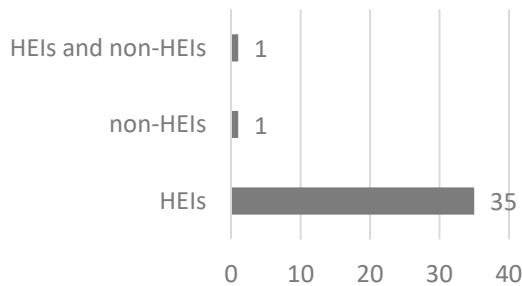


Figure 1.3. *Number of courses offered by HEIs and non-HEIs*

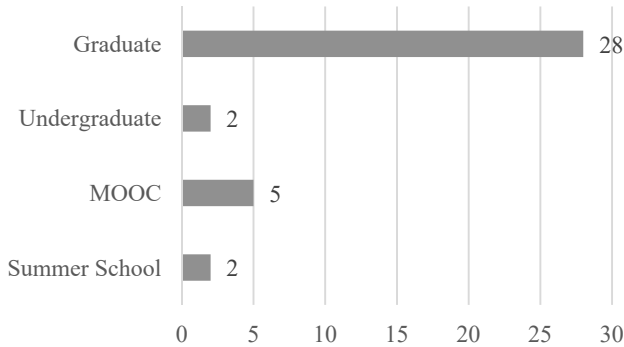


Figure 1.4. *Course type by number*

Regarding the learning environment of the courses, there are lecture-based and studio courses. Most studio courses focus on case studies, including fieldwork and workshops to develop adaptation and mitigation strategies. Courses focusing on heritage impact assessment methods, heritage vulnerability and conservation mostly offer a model of lectures and seminars together. Most of the courses in the curriculum are instructed by architects and urban planners. These courses have limited cooperation with other fields such as engineering, sociology, history, economy, management, environmental and climate sciences. MOOCs, on the other hand, are often taught by groups of experts with backgrounds in architecture, urban planning, civil engineering, history, environmental economics, social sciences and climate change.

When we analyzed courses according to their focus and extent of dealing with climate change and heritage, two main categories are evident: the courses offered in the built environment-related programs (A) and the climate science courses (B) (Table 1.1).

Heritage and climate change-related courses offered in architecture/built environment/urban planning departments present varieties regarding their scopes and the extent of their studies. Four categories of courses are observed in this category. A1 courses are the built environment courses. Neither climate change nor heritage is the main focus, yet climate change's impact on heritage is one of the issues discussed. A2 courses deal with the issues of the built environment and climate change. However, they do not devote the entire course to heritage and climate change studies. These courses are offered in Architecture, Civil Engineering, Building and Energy Technology departments at both the undergraduate and

graduate levels. While the broader focus of these courses is on climate change and the built environment, climate-resilient heritage is a small part of them.

Courses on built heritage constitute the third category (A3). These courses focus on built heritage throughout the entire semester/trimester/quarter. One of the topics they discuss is climate-resilient heritage as part of a broader discussion. Most of these courses are offered in architecture and urban planning graduate programs provided by architects and urban planners. Sometimes, engineers, landscape architects, historians and experts from different areas join the team as well. These courses differ in approach and focus; thus, they are divided into two subcategories. There are some design courses (A3.1) that develop adaptation proposals for the heritage at various scales, including rehabilitation and retrofitting. Another category of courses (A3.2) is mainly offered by graduate programs in conservation, preservation or building science. Within the context of conservation, these courses discuss the impact of climate change, vulnerability and adaptation of built heritage.

The last category of courses on built environment-related programs (A4) addresses both climate change and built heritage. The courses focus on climate change and built heritage throughout the semester/quarter/trimester. These courses can be examined under three subcategories (A4.1, A4.2, A4.3). The first subcategory (A4.1) includes courses offered by graduate programs in conservation, preservation or building science. These courses deal with the risk and impact assessment of climate change on built heritage. Design courses constitute another subcategory (A4.2). Courses in this category give students a critical perspective on vulnerability and adaptation through design to adhere to governmental measures on flood areas and the SDGs (Goals 6, 11, 13). The last subcategory (A4.3) contains courses focusing on heritage assessments and rehabilitation, and also examines multidisciplinary aspects of cultural heritage as a resource for mitigation and adaptation.

The courses offered by the Departments of Natural and Social Sciences on climate change constitute category B. Although these courses do not directly address its impacts on built heritage, climate change is addressed as a phenomenon to be understood through the lens of natural sciences. Climate change has complicated causes and implications rooted in historical, social and economic factors. With a foundation in both natural and social sciences, these courses deal with climate change issues with a focus on cultural geography, history and sociology. Courses in Category B can be evaluated in three subcategories according to their main focuses: climate science courses (B1), courses dealing with social and geographic implications of climate change (B2) and courses addressing the built environment as an agent for mitigation or intensifying climate change (B3).

Categories of courses according to their focus and extent of climate change and cultural heritage	
Main focus of the courses	Title of the courses
A. The built environment and climate change courses	
A1. Built environment courses where neither climate change nor heritage is the main focus. The impact of climate change on heritage is one of the issues discussed	
– Structure and materiality of architecture	– Construction and Durability (ENSA Toulouse, France)
A2. Courses with a focus on the built environment and climate change heritage is one of the issues discussed	
Climate resilient built environment	– Climatic Heterotopias (INSA Strasbourg, France) – Climate-adapted Construction and Operation (BTU Cottbus, Germany) – Radical Sustainable Architecture (Aarhus School of Architecture, Denmark) – Climate Change and Design (Eskişehir Osmangazi University, Türkiye) – (Re)Imagining Port Cities: Understanding Space, Society, and Culture (TU Delft, The Netherlands, MOOC by Edx)
A3. Courses on built heritage Climate change is just one of the issues addressed	
A3.1 Adaptation through transformation at various scales, including rehabilitation and retrofitting	– Heritage and Architecture Design Studio: Research and Architectural Design (TU Delft, The Netherlands) – Architecture, Heritage, and Eco-construction (ENSA Bretagne, France) – Heritage and Old Buildings (ENSAP Lille, France) – Trans-Form (ENSA Normandie, France) – Architecture and Heritage (ENSA Grenoble, France)
A3.2 Vulnerability, conservation, preservation, restoration	– Geophysics and Cultural Heritage (University of Venice Conservation Science and Technology for Cultural Heritage, Italy) – Environmental Impact on Materials Deterioration and Aging (Università di Bologna Laurea Magistrale in Science for the conservation-restoration of cultural heritage, Italy) – Course on Architectural Heritage (INSA Strasbourg, France) – TD de techniques patrimoniales d'intervention durable (ENSA Clermont-Ferrand, France) – Doctrines Intervention on Built Environment (INSA Marseille, France) – Heritage under Threat (Universiteit Leiden Centre for Global Heritage and Development, The Netherlands, MOOC by Coursera) – Atelier Architectural Restoration Project (Politecnico di Torino, Italy) – World Heritage and Site Management (Kadir Has University, Türkiye)

A4. Built heritage and climate change courses	
A4.1 Vulnerability, adaptation, and conservation	– Climate Change and Risk Assessment for Cultural Heritage (ICOMOS Argentina, MOOC) – Heritage Impact Assessment Transformation Strategies for Climate Change (BTU Cottbus, Germany)
A4.2 Adaptation and transformation	– Master Project on Vulnerability (TU/e, The Netherlands) – Design course: de Haven van Antwerp (RAvB, The Netherlands)
A4.3 Climate resilient heritage Heritage as an asset for mitigation and adaptation	– Graduation project-topic: Resilience and climate change (TU/e, The Netherlands) – Built-up Heritage Over Time (TU/e, The Netherlands)
B. Climate change courses Heritage is minimal or absent in the content	
B1. Climate science courses	– Making Climate Adaptation Happen (Wageningen University, The Netherlands, MOOC)
B2. Courses dealing with social and geographic implications of climate change (the content of the course based on both natural and social sciences)	– Adaptation Governance (University of Groningen, The Netherlands) – Design of Climate Change Mitigation and Adaptation Strategies (Wageningen University, The Netherlands) – Uncertainty and Climate Change. Challenges for a UNESCO World Heritage City (UNED, Spain, Summer School)
B3. Courses focusing on the built environment as an agent for mitigation or intensifying climate change.	– Climate Change, Health and Architecture (Aalto University, Finland, Summer School) – Planning for Climate Change in African Cities (United Cities and Local Governments of Africa, African Local Government Academy, Erasmus University Rotterdam, Institute for Housing and Urban Development, MOOC by Coursera) – Climate-Responsive Planning and Design (Wageningen University, The Netherlands)

Table 1.1. *Courses according to their focus and extent of climate change and cultural heritage⁴*

For the above courses, two different analyses were made. Figure 1.5 illustrates how many times the concepts of resilience, impact, vulnerability and adaptation appear in their content. Figure 1.6 is a graphic presentation of our results that indicates which of the concepts of resilience, impact, vulnerability and adaptation are studied in conjunction with one another⁵. Resilience, impact, vulnerability and adaptation are mostly addressed together. Resilience, vulnerability and adaptation

4 Available at: <https://www.ecreha.org/research>.

5 Available at: <https://www.ecreha.org/research>.

are the second most frequently addressed concepts. Adaptation is the most addressed concept. Vulnerability is most often addressed alongside adaptation.

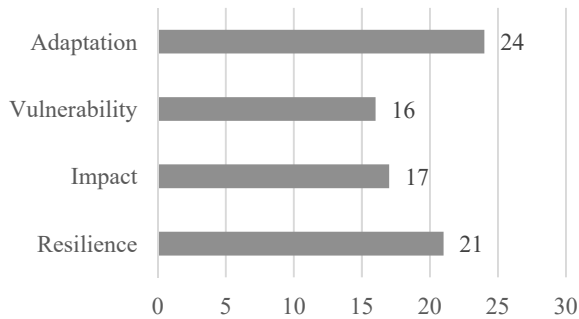


Figure 1.5. *Frequency of each theme*

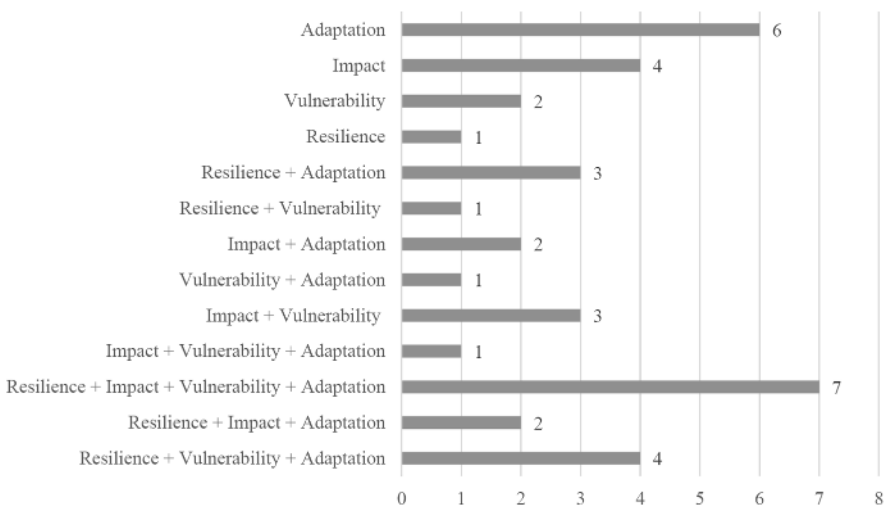


Figure 1.6. *The groups of concepts of resilience, impact, vulnerability and adaptation*

1.4. Conclusion

The research revealed that heritage education addresses climate change issues in several ways with different methods and objectives. While some have a clear focus on mitigation through nature-based solutions, others study in the scope of heritage studies. However, the curricula of HEIs lack a specialized course on the intersection of cultural heritage and climate change. ICOMOS promotes a dual approach to climate change, which addresses the risks climate change poses to cultural heritage by declaring heritage as a resource for climate action and resilience. Yet, this dual approach is rarely considered in the curricula and courses. Understanding the role heritage plays in climate actions and how it contributes to community resilience is important for future architects. In order to take part in climate action, architects need to comprehend how multi-level planning mechanisms and cultural heritage conservation can be integrated. Yet, it can be challenging because of the lack of interdisciplinary knowledge on climate change and cultural heritage in architectural education.

It is obvious that there is a need to bridge the gap between the mechanisms, governance and research and education in order to comprehend multi-level planning mechanisms and deal with potential conflicts between diverse levels of planning frameworks. Future practitioners/policymakers/designers need to be better trained and qualified to apply traditional construction techniques, cultural meanings and implications, and innovative technological approaches in adaptation. Therefore, the curricula should include courses that emphasize how built heritage is vulnerable to climate change and the pivotal role it plays in developing climate-adaptive strategies.

1.5. References

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