A MULTIDIMENSIONAL MODEL FOR PLACE-BASED EDUCATION THROUGH A CROSS-MEDIA APPROACH AND NEW TECHNOLOGIES. THE T-PLACE PROJECT

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KEY WORDS: Place-based education, cross-media approach, cultural identities and memories.

ABSTRACT:

In the world, Italy, and Tuscany in particular, is the country with the highest number and concentration of UNESCO Heritage sites. To fully understand, preserve and promote the richness of these areas, different research perspectives must be kept together and a proper educational approach to the places is needed to fully valorise this asset, which also has the highest economic value in the tourism industry. The T-PLACE project, funded by the PNR 2021-2027 and currently running at the University of Florence, aims at creating an inclusive and participatory model of cultural education focused on place and its assets, also exploiting new technologies such as the X-Reality and 3D modelling. T-PLACE is grounded on a strong multidisciplinary approach, ranging from Educational Technology to Historical Geography to Geomatics, that will be implemented with a full-range pilot in the surrounding of Florence, in the area of Sesto Fiorentino, of particular interest for its diffused cultural heritage and social testimonies. T-PLACE will actively involve the citizenship, in particular in the X-Reality and 3D modelling. T-PLACE is grounded on a strong multidisciplinary approach, ranging from Educational Technology to Historical Geography to Geomatics, that will be implemented with a full-range pilot in the surrounding of Florence, in the area of Sesto Fiorentino, of particular interest for its diffused cultural heritage and social testimonies. T-PLACE will actively involve the citizenship in training, documenting, and exploring activities with the objective of encouraging the digital transition in the interpretation of tangible and intangible cultural heritage and contributing to the formation of resilient, inclusive and cohesive societies.

1. INTRODUCTION

In the world, Italy is the country with the highest number and concentration of UNESCO Heritage sites, and Tuscany hosts eight of these sites, expressing a landscape permeated by history, archaeology, art, and society. As an example, it can be mentioned what Unesco says with reference to “Ville Medicee”:[1] “The villas] represent an innovative system of construction in harmony with nature and dedicated to leisure, arts and knowledge (...) The Medici villas form the first example of the connection between architecture, gardens, and the environment and (...) their gardens and integration into the natural environment helped develop the appreciation of landscape characteristic Humanism and the Renaissance.”1. This definition provides a precious insight for the understanding of the concept of place, as a seamless combination of art, culture, history, nature and society contributing to define the genius loci of the place.

In particular, Tuscany and Florence area express a landscape permeated by history, archaeology, art, and society (e.g. see Azzari, 2006). To fully understand these places, and therefore preserving and promoting them, these different perspectives must be kept together, and a proper educational approach is needed to maintain and develop this asset, which also has the highest social, historical and also economic value.

In this sense, the educational approach to the places lies at the intersection of geography, cultural heritage, and pedagogy, while digital technologies and multimedia contents can foster a deeper understanding of the territorial richness made by art, culture, history and landscape and societal patterns. Nowadays, multidisciplinary, interdisciplinary, transdisciplinary research paths are particularly emphasized in the current scientific debate to the extent to which cross-disciplinary collaborations are fundamental for reconnecting too specialized knowledge and languages in front of the complexity of the real world.

Physical spaces can be documented by different points of view contributing to build the overall knowledge: historical sources (iconographies, archival documents, cartographies), multimedia tools (videos, podcasts, etc.), scientific analysis (diagnostics, structural assessment), documentation of the geometry recording high-resolution spatial data and integrating information from different sensors (Tucci, 2015). The need for documenting the places through the most advanced technologies is linked to its complex and constantly evolving nature requiring innovative approaches to fully understand it in all its changing aspects (e.g. see Azzari et al., 2021). Documentation, in its broadest sense, may be applied to existing assets of the places, to increase and to enhance its knowledge and awareness, but it can also involve intangible aspects and related actions to engage the community through crowdsourcing of data, storytelling and storymapping.

In this sense, technological innovations can serve both as support tools for territorial knowledge/documentation and for pedagogical/educational applications so that digital technologies may become vehicles of mediation between innovative educational approaches to territorial complexity. The concept of “mobile learning” is particularly appropriate for the place-based education (Camunas-Garcia et al., 2022; Pachler, Bachmair and...
The T-PLACE project, funded by the PNR 2021-2027 and presently running at the University of Florence, involving three departments (Education, Languages, Interculture, Literatures and Psychology / History, Archaeology, Geography, Fine and Performing Arts / Civil and Environmental Engineering), has the goal of fostering place-based education and aims to create and develop an inclusive and participatory model of cultural education focused on a place and its assets, based on the use of cross-media tools (especially Augmented Reality, 360° video and Virtual Reality) with a positive fallout on citizenship and tourism. T-PLACE is grounded on a strong multidisciplinary approach, ranging from Educational Technology to Applied and Historical Geography to Geomatics and 3D representations, to develop an educational model that will be implemented with a full-range pilot in the surrounding of Florence, in the area of Sesto Fiorentino, which is of particular interest for its diffused cultural heritage. To foster the active participation of the citizenship, who is the final beneficiary of the activities, the Municipality, as well as public and private local institutions, will be involved to engage the citizens – both individuals and associations – in training, documenting, and exploring activities.

The T-PLACE project has been designed to be completely aligned with the principles of the Faro Convention2 which acknowledge the cultural heritage as a key factor for the democratic and human value. In this sense, the cultural heritage, in a broad meaning, is a foundation that encompasses educational practices, creative and expressive processes, community life, democracy and citizenship. It is worth to mention that the cultural heritage, especially in Italy, is not merely linked to museum collections or human artifacts but is extended to the landscape and more generally to the genius loci, that is the historical memory of places, landscapes, and heritage of identity. The correct use and valorisation of the area, through geomatic disciplines and, more in general, of advanced technologies, has also the objective of encouraging the digital transition in the interpretation of tangible and intangible cultural heritage, also by enriching the educational offer to better contribute to the formation of resilient, inclusive and cohesive societies.

2. THE T-PLACE PROJECT

As mentioned, the T-PLACE aims at designing and developing a model for the place-based education which considers several dimensions, including pedagogy, cultural heritage, geography, technology for the study of the places. According to Giorda and Puttilli (2011) the place, as a concept used to define the space of interactions and projects, represents the spaces where communities live and coexist, and therefore the spaces where also educational actions occur together with the social construction of civil coexistence and interactions over time. It is a concept that cuts across many disciplines and finds significant development in the current geographic literature, to the point that the denomination of “geography” has, sometimes, been replaced with that of “territorial science”.

A geographical approach to the analysis of territorial complexity can therefore provide a theoretical and operational contribution in the design of educational strategies for those involved in schooling, projects, policies, and educational initiatives. It also provides citizens with an awareness of the possibilities and limitations offered by a place, of the availability of human and natural resources, of the cultural heritage and local identity, of the critical issues to be addressed and the opportunities to be seized, of the strengths and weaknesses, of the value of that place as a construction of identity, as an inclusive space. Specific initiatives can therefore be implemented aiming at forming responsible citizens inhabiting the territory, in the acquired awareness of the close interdependence between person and community (Pignalberi, 2020).

The educational approach adopted for the study of the places, mainly relies on “mobile learning”, which enables the learner to be ‘on the move’, with anytime anywhere access for learning (Ranieri and Pieri, 2014; Sharpley and Spikol, 2017; Traxler, 2016). Thanks to wireless connectivity, indeed, the locus of computation doesn’t need to be limited to the desktop or a classroom but can be embedded in the environment where we live (Pachler, Cook, Ranieri and Manca, 2012), providing “the facility to digitally augment the physical world in various ways, by linking digital information with physical artefacts or the environment” (Price, 2007). Mobile and augmented reality learning has been the object of several studies (Pachler, Bachmair and Cook, 2010; Akçayır and Akçayır, 2017; Ranieri et al., 2022), which report positive experiences, especially with respect to student motivation and involvement (Bacca et al., 2019; Di Serio, 2013). These systems seek to improve the learning process (Garzón and Acevedo, 2019), allowing the learner to actively participate in the experience rather than passively consuming knowledge and information. A relevant technology that is envisaged to support this approach will be the XR, and mainly the so called “augmented reality” where the adjective “augmented” refers to the opportunities that this technology offers to access visualizations overlapping with real objects, allowing the learner to perceive the various aspects of the physical world in a new light and discover elements that are not easily perceptible in the non-augmented world. These systems seek to improve the learning process (Garzón and Acevedo, 2019), allowing the learner to actively participate in the experience rather than passively consuming knowledge and information.

The documentation approach aims at the production and management of accurate and broad information to fully record the richness of the territory and places.

The cognitive process is made not only by the sum of the individual social, political, economic, historical, and cultural aspects pertaining to the territory but also by the integration of such information and by the definition of mutual relations to the whole context where the place is located. The geospatial documentation of the territory provides physical references about the geometry and position of the objects as well as about the related phenomena and thematic information.
The complexity of the territory concept is reflected in the various documentable components that characterize it:

- morphological and physical features with defined geometries, such as buildings, roads, infrastructure, etc.
- qualitative characteristics, delimited by more or less arbitrary boundaries, such as geological substrates, land uses, vegetation, but also social aspects affecting the inhabitants and users of that territory
- diffuse quantitative characteristics, representable by discrete gradients (ground temperature, elevation, wind speed, pollution, etc.)

The recording process of such elements uses different documentary resources and tools, where the geometric representation of the territory serves as a basis to refer information with a temporal dimension.

The latter aspect can be realized by using technologies belonging to the field of Geomatics, to document, model, simulate, and visualize the characteristics of the place and its assets to facilitate its knowledge and management. Digital documentation uses technologies such as laser scanning systems and photogrammetry, which can be used from the ground or on aerial platforms, like drones or airplanes, for the geometric reproduction of space at different scales (from the territory to the city, from the building to the individual objects) (Gomarasca, 2009; Bitelli, 2017). In addition, the use of sensors able to detect different ranges of the electromagnetic spectrum ( multispectral, thermal, hyperspectral) allows the spatial data to be equipped with thematic information for the characterization of complex phenomena. The overall information produced needs common reference systems, provided by topography and positioning systems (GNSS), to be correctly read and interpreted from both a metric and spatial point of view. The multi-sources data obtained from digital surveys of the places (geospatial, temporal, thematic, and semantic) may converge into "digital twins", i.e. complex systems that go beyond the simple meaning of a virtual replica of a physical object, that create representations and generate interconnected information to guide targeted actions. The geolocalisation of data and the use of Geographic Information Systems (GIS) constitute an additional tool for geospatial analysis, simulations, and visualization of data on various levels for management and decision-driven purposes.

At this end, the affordance of mobile devices of offering digitally facilitated site-specific learning has relevant pedagogical implications for the place-based education and cultural heritage (Camunas-Garcia et al., 2022; Pachler, Bachmair and Cook, 2010; Petrucci and Agostini, 2016; Ranieri and Pieri, 2014; Ruiz-Callecja et al., 2023). For instance, learner’s information on the places can be dynamically integrated over time and space, supporting new forms of learning and extending students’ reflections both in the physical world and in educational formal settings. The exploitation of XR and advanced digitisation and 3Dmodelling can greatly support the learning process, for instance with integrated and “augmented” visualizations of the same historical building over the time, based on the use of diverse representational media and connecting relevant information both digital and physical. Furthermore, augmentation can involve abstract concepts associated to certain contexts or key elements of the environment or also objects which are significant for the abstract concepts associated to certain contexts or key elements of the environment or also objects which are significant for the abstract concepts associated to certain contexts or key elements of the environment or also objects which are significant for the physical and semantic) may converge into “digital twins”, i.e. complex systems that go beyond the simple meaning of a virtual replica of a physical object, that create representations and generate interconnected information to guide targeted actions. The geolocalisation of data and the use of Geographic Information Systems (GIS) constitute an additional tool for geospatial analysis, simulations, and visualization of data on various levels for management and decision-driven purposes.

4. THE PARTICIPATORY APPROACH

The T-PLACE project aims at developing a participatory approach through crowdsourcing and citizen science, with a collaborative acquisition of data of territorial assets and local heritage, generating information, innovation, and identification processes. To favour this approach the technologies used have been selected to be inclusive, user-friendly and low-cost, within everyone’s reach. As already underlined, the UDL principles will be also the guidance to develop contents suitable also for people with difficulties to promote an approach as inclusive as possible.

The final beneficiary of the action is therefore the community, with a focus on non-expert citizens to be engaged as active users, i.e. direct producers of data and information. The acquisition of information on the place where they live therefore becomes an opportunity of training and approach to the territorial complexity. The citizens are identified as sensors themselves, capable of acquiring information to be shared on specific platforms, as in the OpenStreetMap project, where voluntary geospatial information is acquired by users all over the world and collected in a web-database containing spatial data such as roads, buildings, points of interest, etc. Furthermore, collaborative events based on digital photogrammetry can be organized, thanks to the progressive “democratization” of such technology, coupled with the wide availability of devices for image acquisition (smartphones, tablets, digital and 360° cameras), (Tucci, 2018). Starting from simple images it is possible, through appropriate acquisition and processing workflows, to reproduce reality-based objects through 3D models. In addition, to increase the sense of belonging to the community, participants can be involved in the production of cross-media narratives about the explored places using mobile devices and very easy-to-use devices (Ranieri and Bruni, 2013; Ranieri and Pachler, 2014). Crowdsourced contents can be spread out through social networking sites for an inclusive promotion of the cultural heritage. This "learning-by-doing" approach based on empowering traditional media users as creative media producers can improve the level of participatory engagement.

3 https://www.openstreetmap.org/#map=6/42.088/12.564

This contribution has been peer-reviewed.
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cultures in our societies, with relevant implication for democratic and active citizenship, as also highlighted by Jenkins (2010). The development of advanced use of virtual contents for the knowledge of the places and its cultural, social and historical heritage, although requiring expertise and adequate economic resources by the content producers, will be at the available to the widest audience which range from non-experts to experts (i.e. specific operators, citizens, students). Reality-based digitization technologies (photogrammetry, laser scanning systems) can be used to document the current state of an object (as it is), with 3D models produced as outputs that can be used in extended reality applications (Teruggi, 2021). In addition, modelling tools can be integrated to add virtual contents to simulate previous or future conditions of the object (as it was, as it will be), based on research or information provided by experts in the field (Tucci, 2021).

Applications range from reconstructions of virtual archaeology (Campanaro, 2022), to virtual landscape (Azzari, 2017), and virtual restoration of objects (Banfi, 2019, Tucci, 2017) or to immersive videos for exploration (Ranieri et al., 2022).

5. THE MULTIDIMENSIONAL MODEL

The T-PLACE project is conceived not only as a single action purposely developed for the Florence area but aims at designing and developing a multidimensional model to be scalable and replicable in other places considering the specific relevance of each place.

This model can be represented on three levels:

- Inner level – EDUCATION
- Medium level – DOCUMENTATION
- Outer level – EXPLORATION

The conceptual architecture of this model is represented in the Figure 1.

![Figure 1. The multidimensional model.](image)

The Inner Level is mainly conceived as a physical place focused on education such as a cross-media classroom, equipped with immersive devices, for the training of experts, such as teachers or educators. This place will be used to deliver courses on education, geography, cultural heritage and geomatics. At this purpose, for the T-PLACE project, a dedicated classroom, equipped with XR facilities, will be developed at the University of Florence as a permanent asset for place-based education.

The Medium Level is conceived as virtual plurality of places spread across the territory (i.e., documentation centers, small museums, but also private collections) linked to the area to be explored, where citizens can be involved in the knowledge and awareness of the area in the multiple perspectives of geography, culture, history, art, and so on.

The Outer Level is conceived to be a place, strictly linked to a particular area, where the citizens can be trained before exploring the area; these places could also be equipped with light immersive devices to prepare the visit, a sort of cross-media outposts on the territory.

6. THE CASE STUDY

This multi-dimensional approach will be implemented through a case study specifically designed on the assets of Sesto Fiorentino, an area in the surroundings of Florence, especially rich in naturalistic, artistic and societal assets. For the proposed case study multimedia modular contents will be co-designed to be used not only for educational purposes but also for communication, dissemination and awareness-raising, addressing different stakeholders as Tuscany municipalities, the Tuscany Region, and/or private entities – such as banking foundations, pro loco and cultural associations – in order to promote the places.

Due to the versatility of the technology applied to the different needs of the project, the “models” applicable to the case studies selected within the project can fulfill two different functions:

- Didactic/preparatory function, through the creation of multimedia contents to support immersive reality learning with the aim of transferring information before physically going to the places of interest in the area. Three-dimensional digital content can help provide preliminary knowledge of a specific aspect of the area.
- Fruitive/experiential function, through direct experience on the field, with a more exploratory connotation based on a combination of mobile practical activities and immersive reality contents connected to the educational paths of the previous function. Specific cases study will be selected on the places according to educational needs and agreements with local entities.

Multimedia contents, including XR production, will be produced to investigate different aspects, and territorial assets, of the area of Sesto Fiorentino such as:

- the landscape transformation (i.e., Monte Morello; the Florentine plain; the wetlands);
- the diffuse cultural heritage (villas, factories, artifacts) and the historical collections (i.e., the porcelain from the Doccia manufacturing and museum, the the archaeological evidence of Roman and Etruscan settlements);
- the changes in the socio-economic fabric through storytelling collected from residents and privileged witnesses (i.e., the testimony of workers' struggles and peasant songs).

The investigations will involve the landscape, and its transformations, as well as archaeological, historical, artistic, and cultural heritage with attention to signs imprinted on the places over time.

Emphasis will be given to the significant tangible and intangible landscape components such as:
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- persistence of historical rural landscapes;
- minor hydrographic network and related artifacts;
- historical roads;
- place-names.

This case study will be supported by the historical cartographic and photographic documentation of the University of Florence - formerly the Institute of Geography in particular - and other Florentine conservatories producing materials suitable for the different purposes set out above. As a part of the case study, the documentation will be hosted both in a part of Palazzo Fenzi, an historical building property of the University of Florence and in dedicated spaces in the area of Sesto Fiorentino.

For the “exploration” of the area the users (students, citizens, enthusiasts) will be provided with a mobile app developed for the purpose of place-based education with the help of augmented reality. This app, also through the use of QR codes diffused on the territory, will superimpose to the selected local assets (e.g. landscape, architecture, art) multimedia augmented contents (e.g. historical representations such as “As it was, As it is”). It is also envisaged the use of 360 videos, also exploiting the use of drones, for a highly engaging vision of the landscape.

According to the model depicted above, the Inner Level (EDUCATION) will be based in the Palazzo Fenzi in Florence, with the cross-media classroom developed in the previous activity.

The Medium Level (DOCUMENTATION), being conceived mainly as virtual, will be based in several places spread across the area of interest. These places, in addition to the documentation already present, will provide an environment in which digitized material from existing collections or produced specifically for the project will be available.

For the Outer Level (EXPLORATION) instead, some outposts have been identified according to their closeness to the citizens and to their high potential for their exploitation.

According to the general architecture the case study can be represented as in the following Figure 2.

The beginning of the case study is planned from Autumn 2023 with the production of digital contents, forming the initial core of the project documentation, to be made available to the public through a platform specially developed by the University of Florence. This core will later be supplemented by further documentation either specially developed for the project and collected from the various documentation centers of the University of Florence and from local sources, with the aim of creating a permanent multimedia repository to be made available to the public and specialists.

The case study will be a pilot implementation of the T-PLACE model both for academic and not-academic purposes. The latter perspective will be particularly considered in developing some of the contents to make it suitable to non-expert audiences to foster an inclusive education to the place and its assets. Moreover, it must be observed that since the contents can serve as tools for promoting the touristic assets of the area and being T-PLACE a flexible and transferable approach to place-based education, it can inspire other important places in Tuscany and elsewhere in the production of educational contents for similar purposes.

7. THE EXPECTED IMPACT

T-PLACE, besides being a research project aiming at defining an innovative and scalable model for the development of an education model for the study of the places, is designed as an impact-oriented action being addressed at different levels of beneficiaries.

The main target of the project are the citizens in a broadest sense. The citizenship, not only the residents in the area, will benefit from the deployment of installations that, leveraging on the most innovative technologies and contents developed on purpose and proposed in a captivating way (e.g., through extended reality) will raise the awareness about the territorial assets in terms of art, culture, and history. This will not only have a positive impact on the culture but also will strengthen the feeling of belonging to the places, thus fostering the inclusion especially for the new citizens coming from other countries. Furthermore, the contents will be developed with particular attention to people with reduced abilities and special needs so that the enjoyment of the places could be the largest possible.

Another important target are the institutions both public and private (e.g. municipalities, museums, associations) that could benefit, directly and indirectly, from the valorisation of the local assets. In fact, raising the awareness about environmental wealth and strengthening the sense of belonging will help in preserving the environment and protecting the cultural heritage, for instance reducing vandalism or indiscriminate littering. An important impact is also expected, in the medium-long term, from an economic perspective, since the cross-media contents made available, also as a web-based application, would help in attracting tourists in those places that, despite their cultural and historical richness, are often obscured by the so called “città d’arte” (Florence, Rome, Venice…) promoting therefore a slower and sustainable tourism and fostering new economic opportunities. In this regard the T-PLACE project has already set-up a network of territorial institutions who expressed their interest in supporting the activities and in adopting the model. At the end we shall also mention the positive effects this action may have for the productive fabric of the area, especially the SMEs with IT skills in producing innovative contents and support to the institutions.

The third target is the researchers’ community. The multidisciplinary approach followed in the T-PLACE project is...
not limited to the competences made available in the Consortium but needs to be enlarged to other competences (i.e. archaeologists, geologists, sociologists, agro-food scientists). The proposed model can therefore be enlarged and provide a fruitful, and yet not fully explored field of study and collaboration among different domains of research. It is also worth mentioning the technological relevance of the proposal, leveraging the innovation in representing contents with the XR also with the perspective to customize the use of these contents with the help of the Artificial Intelligence by developing a recommendation system for personalised tours.

8. CONCLUSIONS

The T-PLACE project has the ambition to design and fully implement a multidisciplinary educational approach to the territorial assets for a deeper knowledge and understanding of the social, historical, artistic and landscape heritage with the aim of involving the entire citizenship as an active stakeholder. The project is conceived as a multidimensional model to be easily replicated in different areas, leveraging on a participatory approach involving the citizens as direct producer of contents and information.

To prove the validity of the model a full case study will be implemented, starting from Autumn 2023, in the surroundings of Florence in Sesto Fiorentino an area especially rich in naturalistic, artistic, and societal assets. For this case study original multimedia contents – ranging from storytelling, digitisation products and XR contents – will be developed and supported by the existing documentation from different sources, both from research institutions and private associations. These contents will be made available both for the experts – i.e. the persons to be trained in the cross-media classroom developed for the project at the University of Florence – and for the citizens in the documentation centers of the area and, in a lighter format, diffused all over the area to be used also with mobile devices (i.e. through QR code).

To ensure the sustainability of the project local public and private local institutions, will be involved with the aim of fostering the engagement of the citizenship in training, documenting, and exploring activities with the objective of encouraging the digital transition in the interpretation of tangible and intangible cultural heritage. This educational offer will help to better contribute to the formation of resilient, inclusive and cohesive societies.

ACKNOWLEDGMENTS

The present work, “A multidimensional model for place-based education through a cross-media approach and new technologies. The T-PLACE project” (CUP B55F21007810001) is supported by the European Union – Next Generation EU.

REFERENCES


Azzari M. (a cura), 2006: Atlante GeoAmbientale della Toscana, Novara, De Agostini - Regione Toscana


Giorda C., Puttilli M. (a cura), 2011: Educare al territorio, educare il territorio. Geografia per la formazione, Roma, Carocci


Jenkins H., 2010: Culture participative e competenze digitali. Media education per il XXI secolo, Guerini e Associati, Milano.


Pignalberi, C., 2020: “Learning and Territory. Design as a leverage for sustainable development in local communities”. Form@re - Open Journal per la Formazione in Rete, 20(2), 71-85.


