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Back to School. Addressing the Regeneration of the Italian School Building Stock in the Latent Pandemic Contingency

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Abstract. In 2020, the health emergency put school buildings to the test, highlighting the limits of a dated heritage in need of urgent interventions. The approximately 40,000 buildings that make up the Italian school infrastructure are a layered and widespread legacy throughout the country, which now requires rethinking in light of the social, demographic, and pedagogical changes that have arisen in recent decades. The opportunity to invest in the existing school building stock, fuelled by national and European funds, requires an extended effort of exploration, analysis, and measurement of the school building heritage. In this framework, the *Re-school* research project was born to provide tools for systematising knowledge on the Italian school infrastructure. The main objective is to support the public authorities in strategic planning to activate a process of regeneration of the school building stock on a territorial scale. This article describes a proposal for a working method to explore the transformative potential of school buildings, thus allowing the adaptation of the existing infrastructure to face situations marked by sudden change (e.g., a pandemic or a drop in demographics).

Keywords: Educational building; strategic planning; urban regeneration; heritage.

1 Introduction

The COVID-19 pandemic put the global education system into jeopardy, resulting in an unprecedented disruption to education worldwide that has affected more than 1.6 billion students and amplified the pre-existing learning crisis [1, 2].

At least a third of the world's schoolchildren – 463 million children in 188 countries – were unable to access remote learning when COVID-19 shuttered their schools. Globally, from late February 2020 until early August 2021, education systems were on average fully closed for 121 instructional days and partially closed for 103 days [3]. Looking specifically at the Italian situation, according to the Italian National Institute of Statistics (ISTAT) evaluation, about three million children aged 6–17 had difficulties attending school during the lockdown [4].

In this situation, the pandemic put a significant strain on the spaces of existing school buildings. The management of activities in classrooms, the flow of people, the organisation of daily breaks, and the movement of students inside and outside the buildings are just some of the many challenges that the pandemic emergency brought to primary and secondary schools. School principals, teachers, and local authorities have also faced the urgency of rapidly adapting educational spaces to facilitate the return to in-person school activities after the end of multiple lockdowns.

Operating school facilities during a health emergency accentuated the pre-existing limits of a degraded and dated building heritage, which now requires urgent interventions. The approximately 40,000 buildings that constitute the Italian school infrastructure comprise a layered and widespread legacy throughout the country, which has required some rethinking based on the social, demographic, and pedagogical changes in recent decades.

Fuelled by national and European funds and programmes – the first of which was the “Piano Nazionale di Ripresa e Resilienza” – the country now has the opportunity to invest in the existing school building stock through strategic actions (on both the national and local scales) that require an extended effort of exploration, analysis, and measurement with respect to the existing school infrastructure.

In this framework, the *Re-school*¹ research project was founded. The project was developed to provide tools to systematise knowledge of the existing school infrastructure. The main objective is to support public authorities in strategic planning to activate a process of regeneration of the school building stock on a territorial scale [5]. This article, which summarises the early outcomes of the *Re-school* project, outlines a proposal for a working method to explore the transformative potential of existing school buildings in Italy.

2 A transformative model: From typology recognition to design action

During the health emergency, the challenges that local authorities face when dealing with school buildings are related to the management of the ordinary [6]. To develop territorial plans, it is necessary to overcome the logics that have oriented the main models of Italian heritage regeneration to date. The first model is based on *experimental projects* on individual buildings, which encourage qualitative transformations (and serve as a model for other projects) that are enacted on a “case-by-case” basis. Another well-established model is based on *extensive up-to-standard actions*, which have as a main aim compliance with minimum requirements, often without consideration of the intervention’s overall quality [7].

The starting point of the *Re-school* project is the proposal of an alternative model of intervention that attempts to close the gap between the previous approaches. This

¹ *Re-school* is a research project carried out by the Future *Urban Legacy* Lab (*FULL*), based in Politecnico di Torino (<http://www.full.polito.it>). The *Re-school* research team members (2021) affiliated with *FULL* include the following: Matteo Robiglio (scientific director), Caterina Baroglio (executive coordinator), Daniele Campobenedetto, Marco Cappellazzo, Elena Guidetti, Caterina Quaglio, Giulia Sammartano, Nannina Spanò, Ilaria Tonti, and Emere Arco.

reset is based on the consideration of school buildings as territorial infrastructures. Such an approach entails moving from a “case-by-case” model to the adoption of a comprehensive perspective on the whole stock of buildings [8]. The model developed by the *Re-school* research team aims at considering both the identification of homogeneous groups of school buildings according to their physical consistency and the specificities and potentials of different territories.

2.1 Measure

Italian local authorities have access to an extraordinary amount of data on school building heritage, which has been collected in the national database *Sistema Nazionale dell'Anagrafe dell'Edilizia Scolastica* (SNAES) and in its regional “nodes” of the *Anagrafe Regionale Edilizia Scolastica* (ARES) [9]. The research team performs quantitative and qualitative analyses based on these datasets, identifying and quantifying recurring criticalities (e.g., with respect to the issue of sustainability and energy efficiency) and spatial resources (e.g., surplus space in schools located in non-urban areas). The main objectives of these actions are to spatialise and systematise knowledge concerning the school infrastructure and to provide an overview of the existing assets in terms of their transformative potential.

2.2 Assess

The second step involves classifying school buildings (defined by their layout, structure, massing, etc.) and their urban contexts (e.g., access points, relationship with the street network and the built environment in general, etc.) according to some recurring typologies. These typologies are the result of periods characterised by certain historical, legislative, and technical conditions [10, 11] that are reflected in the school building stock across Italy. The typological classification is also intertwined with the distribution of buildings on a territorial scale. The assessment of these two aspects combined aims at identifying statistically significant categories that can provide a concise but comprehensive description of the national school infrastructure. This approach allows the research team to explore the transformative potential of a building on an architectural level, with consideration of all the factors related to the territorial scale.

2.3 Select

By introducing assessment parameters (e.g., resources available for transformation, cost-benefit analysis, etc.), the results of the measurement can be evaluated and prioritised against the objectives of the local authorities. In this way, the analyses can provide guidelines to identify priorities for intervention on a territorial scale.

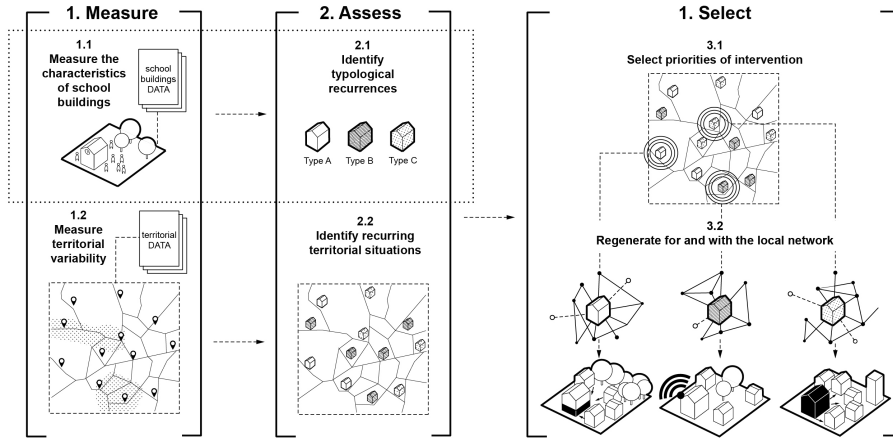


Fig. 1. *Re-school* transformative model. The present article focuses on the connection between 1.1 (Measure the characteristics of school buildings) and 2.1 (Identify typological recurrences), framed by the dotted line.

3 The “ingredients” of building typologies: A preliminary exploration through the case study of Turin

Does the Italian school building infrastructure have spatial resources that can be exploited to improve educational activities? Is it possible to identify the transformative potential of the buildings that make up the Italian school building stock? Could their lives be extended [12]?

To address these issues, it is useful to recognise some recurring types or groups of buildings with similar characteristics among the more than 40,000 Italian school buildings that are representative of this heritage. Such recognition can provide a description of the school building heritage through a limited number of architectural types and therefore constitutes a preliminary step for planning interventions on individual buildings. Each type of school building has a different transformative potential and can be described by four main elements: the layout, the structure, the position in the lot, and the relationship with the built environment.

The following taxonomy constitutes the first hypothesis that has been tested on the school building stock of the city of Turin, which, in terms of quantity, years of construction, and building techniques, is a consistent sample of the national stock [13].



Fig. 2. Abacus of the school buildings of the city of Turin. Source: “EDISCO Piemonte” database. Cartographic bases: “Carta Tecnica di Torino” (2019) and “BDTRE - base dati territoriale di riferimento degli enti” (2019) [5].



Fig. 3. Map representing the distribution of the school buildings in the city of Turin. Source: “EDISCO Piemonte” database. Cartographic bases: “Carta Tecnica di Torino” (2019) and “BDTRE - base dati territoriale di riferimento degli enti” (2019) [5].

3.1 Layout

The layout describes the organisation of spaces in the building. It is an important element in the recognition of transformative potential because it describes the relationship between functional spaces (e.g., classrooms, laboratories, canteens, gyms, etc.) and connective or multi-purpose spaces (e.g., corridors, atriums, and multifunctional spaces), as well as the massing of the building. Six main layout categories could be identified according to a phenomenological analysis of the school building stock of the city of Turin, as well as some of the main studies on Italian school buildings [14]:

1. *Wing*: Single building developed in length, with corridor circulation;
2. *Court*: Wings organised around open space;
3. *Comb-shaped*: main wing on which smaller wings are grafted;
4. *Block*: One or more buildings developed in height, with a central common space;
5. *Pavilions*: Several autonomous buildings, connected by connective spaces, including external ones;
6. *Platform*: Building developed horizontally.

3.2 Structure

The structure describes the construction technology that characterises the load-bearing elements of the building. It is essential to the recognition of potential because it constitutes one of the main constraints for any transformation. With the same method applied before, two main categories can be identified that describe the construction systems of Italian schools:

1. *Continuous structures*: Masonry or concrete walls;
2. *Frame structures*: Pillars and beams with non-load-bearing walls.

3.3 Position in the lot

The position in the lot characterises the way in which the buildings occupy the lot in which they are located [15]. This feature is particularly important for identifying the transformative potential of the school's open spaces. At least three main positions can be identified:

1. *Alignment to one or two sides*;
2. *Alignment to three or more sides*;
3. *Centred*.

3.4 Relationship with the built environment

This element refers to the built environment surrounding the school building. Three main categories can be identified:

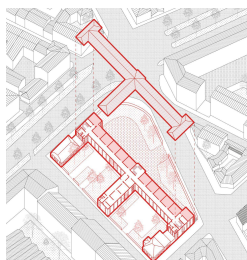
1. *Dense fabric*: The building is surrounded by a dense and compact built fabric;
2. *Edge*: The building lot borders a dense built fabric on one or two sides, and

- the other sides extend towards an open space;
3. *Suburb*: The building lot is surrounded by open spaces or scattered buildings.

4 Recurring school building types and their transformative potential²

The categories of *layout*, *structure*, *position on the plot*, and *context* are useful for identifying the main types of buildings that characterise the Italian school building heritage. To describe this heritage in an almost exhaustive way, far fewer typologies are needed than those that would result from the combination of all the categories proposed. The specific characteristics of each type of building express a potential for transformation that is useful for identifying intervention priorities for parts of the overall heritage and/or actions to be taken on individual buildings.

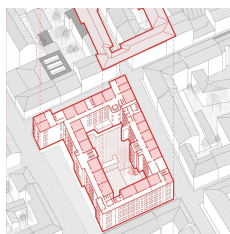
4.1 Classroom-based school



Description. These are wing-shaped, comb-shaped, or courtyard-shaped buildings with two or more floors. They are mainly characterised by corridors that connect a series of classrooms and are aligned on the edges of the lot. The load-bearing structure is continuous and is frequently made with masonry. In many cases, this typology describes mid-nineteenth-century buildings that are widespread in large cities and within the consolidated urban fabric of smaller centres.

Potential. Because of the masonry structure and the traditional technologies used in these buildings, rethinking the layout is particularly difficult. Concerning the interior, the corridors, as well as the large entrance halls, could be suitable for educational activities for individual students or small groups. The classrooms are characterised by above-average surfaces and heights.

4.2 Community-based school



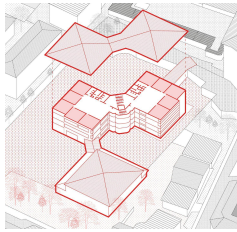
Description. This type includes courtyard- or comb-shaped buildings of two or more floors aligned with the edges of the lot. Inside the building, the classrooms and corridors are characterised by large windows to allow for the flow of natural lighting. Although very often built in dense urban environments, these buildings could have a courtyard; sports equipment (i.e., gym) is usually present within the buildings. In most cases, the frame structure is made of reinforced concrete. These schools were

² All figures of this chapter are published in [5].

built mainly between the 1920s and 1940s; however, examples can also be found from the second half of the century.

Potential. The introduction of reinforced concrete allows for the reorganisation of interiors, enabling the unification of contiguous spaces or the reorganisation of connective spaces. The long corridors could be used as extensions of classrooms. The presence of more than one staircase, due to the articulation of the building wings, enables the diversification of paths within the building. Smooth surfaces and simple volumes, typical of *Rationalism*, ease the intervention process on the building envelope. The courtyards can be considered large open-air “rooms” that can potentially be adapted to host a wide range of educational activities.

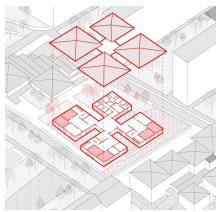
4.3 Cluster-based school



Description. This is one of the most recurring typologies in the Italian school building stock. Its definition is based on the organisational principle of the *cluster*, a group of classes belonging to the same section or year that share a common space. This typology includes block- or wing-shaped buildings with two or more floors, often with separate buildings hosting sports facilities. The structure is often made of reinforced concrete, and cases of prefabricated structures are not rare. Early constructions date back to the 1960s, but many others can be dated to the following decades, up to the 1990s.

Potential. This type is particularly interesting in terms of the transformative potential of the interiors. Wide connective spaces and the possibility of eliminating internal partition walls are conditions that allow the building to host public activities. The position of these buildings within the lot favours the identification of diversified entrances, both to the school lot and to the building.

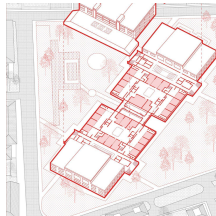
4.4 Small-group school



Description. This typology includes buildings divided into one or more groups of one- or two-story pavilions positioned in the centre of the lot. The structure is, in many cases, realised with prefabricated elements. These are mainly buildings dedicated to kindergarten or primary schools built during the 1960s or 1970s, which can be found in any type of built environment, but especially in large cities.

Potential. The small size and widespread distribution in the urban area favour the reuse of these buildings as territorial structures for various types of services. The pavilions, often directly accessible from the outside, favour diversified access for activities open to an enlarged community. Experimentation with building techniques and materials can pose maintenance and safety problems.

4.5 Platform school



Description. These are buildings developed horizontally, on one or more floors, and often positioned in the centre of the lot. The interiors are characterised by a complex network of circulation spaces, common areas, and services. The load-bearing structure is made of reinforced concrete or prefabricated systems. Many of the schools belonging to this typology were built in the 1970s as community centres in the expanding suburbs of large cities or educational centres in smaller cities (i.e., that host all the school grades in one building).

Potential. The dimensions and complex articulation of the spaces make these schools particularly interesting for the reorganisation of interiors. The oversized connective spaces allow for different types of educational activities to be hosted, while the horizontal extension makes it easy to identify alternative access points. The provision of large open spaces, which is very common in these cases, constitutes important potential for outdoor activities.

5 Conclusions

This article summarises a methodological approach to dealing with the regeneration of building stocks [16] and the evaluation of strategic actions to be taken on individual buildings. In dealing with built objects spread across wide regions and often designed and built by technical departments of public authorities, this approach is intended to facilitate understanding of how the transformation of the ordinary city could take place [17]. The focus of this first exploration is the school building stock; nonetheless, the method is conceived for different stocks that are widespread in a defined territory, with a limited number of managers/owners, and characterised by comprehensive dataset availability. Examples of such territorial infrastructure include social housing stock owned by public or private actors, one-company retail spaces, public or private health system facilities, and open public spaces (e.g., the network of green spaces within a dense urban environment). In all these cases, and within the field described above, it is possible to apply the method we described, especially the part related to the typological identification of buildings, to assess transformative potential.

The double-scale approach (from the territorial to the architectural scale) of this regeneration method is intended to address certain contingencies that affect the built environment (e.g., the pandemic) [18, 19]. In doing so, it can contribute to the development of evaluation tools that support decision-making processes, thus closing the gap between planning orientations and technical or architectural applications.

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