Preservation and Innovation of the Rinnovata Pizzigoni School, a Symbolic Place of the Early 20th-Century Experimental Pedagogy in Milan

Maria Fianchini, Nicola Berlucchi, Franca Zuccoli and Flavia Mainardi

Abstract

In the early 1900s, Giuseppina Pizzigoni launched an experimental pedagogical programme in Milan based on the reform of teaching methods and the design and construction of a new school in keeping with her innovative educational principles. Today, the Pizzigoni method is still implemented in this school, whose special spaces are still in use. However, a lack of investment in maintenance and retrofitting and the emergence of new educational needs and requirements over time has led the building to deteriorate and become functionally inadequate. In 2020, a set of interventions was initiated with a view to conserving this architectural heritage asset. The restoration project demanded an innovative and multidisciplinary approach given its aims of conserving original materials, enhancing the building's energy and seismic performances, updating its systems, and adapting its layout to meet the current needs of the school community. In this paper, we first present the key features of both the Pizzigoni method and the school building. Then we outline the technical issues with the building and the main intervention strategies. Finally, we focus on the co-design process brought to bear on the functional layout of the school building, and the outcomes of this process, which was implemented with the participation of the school principal and teaching staff and the involvement of the other stakeholders, including the main sponsor of the intervention.

Keywords

Heritage preservation · Building restoration · Schools · Learning spaces · Users' participation

1 Introduction

At the beginning of the 1900s, Giuseppina Pizzigoni launched an experimental education programme in Milan, aimed at reforming teaching methods. Based on her innovative principles, a new school was built on the outskirts of the city. The functional organization of the building's internal and external spaces, as well as its interior decoration, were carefully designed to encourage the pupils to be independent, engage in direct experimentation, and perceive beauty.

Since then, the school's teaching staff has always followed the Pizzigoni method and made use of the school's special spaces, such as the farm and the science labs. This means that it is fully aligned with new contemporary educational approaches that assume school places to play a key role in the activation of learning processes.

However, a lack of investment in maintenance and retrofitting and the emergence of new educational needs and requirements over time has led the building to deteriorate and become functionally inadequate.

M. Fianchini (✉)
Politecnico Di Milano, Dept. of Architecture and Urban Studies (DAStU), Milan, Italy
e-mail: maria.fianchini@polimi.it

N. Berlucchi
Postgraduate School of the University of Roma La Sapienza, Roma, Italy
e-mail: nicolaberlucchi@studioberlucchi.it

N. Berlucchi · F. Mainardi
Studio Berlucchi Design Company, Brescia, Italy
e-mail: flavia.mainardi@studioberlucchi.it

F. Zuccoli
University of Milano Bicocca Dept. of Human Sciences for Education "Riccardo Massa", Milan, Italy
e-mail: franca.zuccoli@unimib.it

Opera Pizzigoni Association, Milan, Italy

M. L. Germanà et al. (eds.), *Conservation of Architectural Heritage (CAH)*, Advances in Science, Technology & Innovation,
https://doi.org/10.1007/978-3-031-33222-7_9

In 2020, a plan of interventions was launched with a view to conserving this architectural heritage asset—which is so valuable in both social and cultural terms—and ensuring that it continues to be used with future generations of children.

Through an invitation-only call, Studio Berlucchi Design Company was selected to develop the restoration project. This project was expected to meet a variety of goals, including conserving original materials, enhancing the building's energy and seismic performances, updating its systems, and adapting its layout to meet the current needs of the school community.

The project process was developed with an innovative approach by a multidisciplinary group of experts with the participation of users and stakeholders. Complex issues were addressed following a schedule, with constant attention to both tangible and untangible aspects, at each stage and task, in keeping with the specificity of the place. This meant seeking out solutions that could fulfil the aim to enhance the building's functionality and performance, while respecting the architectural characteristics of the building and Pizzigoni's principles concerning the organization of school space.

2 The Theoretical and Methodological Approaches

2.1 Giuseppina Pizzigoni: A Visionary Educator. The Role of the Archive in Supporting the Project

Before exploring the architectural and restoration interventions implemented at the school, it is essential that we first thoroughly—albeit briefly—examine the work of Giuseppina Pizzigoni (1870–1947). Born in the same year as Maria Montessori and Carolina Agazzi, like these two women, she proposed major educational changes in relation to, relating to the Italian school of the time. Her contribution was not limited to the transformative design of educational action and teaching–learning activities, but also concerned the educational setting: indoor and outdoor. She was undoubtedly one of the first educationalists to have an input in the design and construction of the school building itself (Pizzigoni, 1914).

Pizzigoni's method emphasizes direct action by children, scientific observation, the construction of knowledge from action stimulated by a blend of experimentation, study, and teaching. Pizzigoni never broke away from the praxis of educational and teaching practice to develop theories; rather, her thought was inspired by practical experimentation in her school (Pizzigoni, 1921). Precisely for this reason, Pizzigoni appreciated—from the outset of her work as a teacher—the importance of the environment (both indoor and outdoor) in which the children lived. She viewed the school building as a complex whole and as providing fundamental support to the teaching–learning trajectory. A place where every detail was designed to facilitate learning and at the same time to enhance quality of life, with a specific focus on the bodily needs of children and adults. The school features a diversity of green spaces (the grove, the vegetable gardens and the spaces for animals) designed for outdoor teaching. She dreamed of a school where the indoors would remain in constant dialogue with the outside, and this is still the case today. Furthermore, all the architectural details of the building were meticulously thought out.

In Pizzigoni's own words.

> In fact, the school, seen in terms of its external appearance, is beautiful: its architectural lines are beautiful; its wall decorations are beautiful; its layout, with pavilions rising up amongst the green of the meadows, fields, flower beds, and kiosks is beautiful; as is beautiful the decoration of the bright corridors, and that of all the classrooms. For those who know my spirit, this is not surprising. I inherited a taste for art; I would not be able to live and work in an ugly environment, and so it was natural that, in creating my own school, a school according to my spirit, I would create a beautiful one. But my concern was not only with the architectural lines and the decoration of the rooms: it extended to the child's right to joy; and because joy comes to man from all forms of beauty, I sensed the child's right to a true aesthetic education. (Pizzigoni, 1931, pp.85–86)

In addition to bringing a pedagogical approach to bear on building her own school, so that she could apply her educational method as fully as possible, Pizzigoni was also a scrupulous documenter. From the earliest years of her educational work, she built up a body of documentation comprising photographs, writings, papers, journal articles, and so on, which she collected in the Historical Archive of the Opera Pizzigoni, which was set up by Royal decree in 1927. These documents, as well as maps of the site, served as a valuable resource throughout the entire process of renovating and adapting the layout of the school, as described later in the chapter.

2.2 The Participatory Process for Improving the School's Functional Layout

According to the guideline principles for renovating learning environments issued by international organizations such as the OECD (2019) and implemented in many international projects (Fianchini, 2019), when planning to renovate existing schools, the process for defining modifications to

physical environments should be collaborative and based on exploration of educational practices at the school. The main goals should be to modify traditional building layouts designed for transmissive education and promote new—potentially transformative—visions of how to organize space via lengthy participatory processes. An interesting example of the application of this methodology to a historic building is the renovation conducted by the Foundation for the School and the Compagnia di San Paolo on the Pascoli School in Turin in 2015 (Fondazione Giovanni Agnelli, 2019).

Participatory methodologies with the involvement of the members of the school community were also adopted with a view to enhancing the functional organization of the Rinnovata Pizzigoni school; nevertheless, the objectives of the renovation process were modulated in keeping with the specific context, in which the original experimental pedagogical principles are still considered valid and remain foundational to the school's educational approach.

More specifically, the large school complex is characterized by a series of different buildings (See Figs. 1, 2, 3, 4 and 5), with additional spaces for special activities (such as the swimming pool, the agricultural pavilion, etc.) and by the close relationship between the indoor and outdoor environments, both viewed as fundamental for learning. However, its functional organization has undergone modifications over time, in the absence of an overarching plan. These modifications were carried out to meet needs that emerged due to changing conditions, such as the increase in the number of classes with respect to the original plan, the integration of the school into a larger group of schools, the transfer of some of the original spaces to external organizations to be used as a large school catering kitchen and for educational services for adolescents. All this has led to a series of functional inadequacies, with some rooms over or underused, as well as issues with coordinating the activities and trajectories of the internal and external users.

More recently, this situation has been further worsened by the impact of social distancing requirements due to the COVID-19 pandemic, when all suitable available spaces were transformed into classrooms and the other spaces coopted for the storage of unused furniture and materials.

In this context, the objectives agreed with the school principal and the president of the Opera Pizzigoni Foundation were: to preserve (and where possible restore)

Fig. 1 Primary school

Fig. 2 Nursery

the original design, in keeping with the need to adequately cater for current usage needs, at both the quantitative and qualitative levels, and the mandatory technical requirements; to exploit spaces no longer in use or are due to become available to the school again; overcome the relational and logistical issues generated by the concurrent presence of different organizations; improve the spatial layout of the Opera Pizzigoni archive to facilitate the collection of documents and materials and increase their accessibility to scholars and external students.

The methodological approach drew on the principles of post-occupancy evaluation (Watson, 2003), and the main techniques used were walk-through and focus group discussion (Baird et al., 1996). Thanks to the walk-through sessions, the design team accompanied by the principal was able to observe the features, the operating conditions, and the appearance of all the school environments and also collect information from people in charge and/or users of the different functional areas. It was possible to observe the visible evidence of physical decay and failures, especially those with the greatest impact on user activities and on comfort and safety.

Despite the public health emergency, it was decided to carry out the focus groups in person with the school staff, but limiting the number of participants. The permanent participants in the groups were the principal, the president of the Opera Pizzigoni and a school design advisor to assist with the process of translating organizational needs into spatial requirements. Conversely, different subsets of the teaching staff were invited to each of the sessions, with a view to exploring specific problems related to the different subject areas, especially those with a laboratory component, in addition to generic issues. The in-person meetings made it possible to discuss the issues in light of the floor plans of the buildings, a fundamental condition for enabling the focus group participants who had no architectural expertise to interpret space. In contrast, online meetings were held with the representatives of the external bodies and stakeholders, namely, the representatives of the technical office and educational services of the City Council and of CityLife jsc, the main sponsor of the renovation project. Between one meeting and another, the staff in charge of the restoration project worked hard to sum up the group's thoughts and proposals, assess them from a technical view,

Fig. 3 Agricultural pavilion

discuss them with the project sponsor, update the plans, flag any critical issues, and draft possible solutions for the next steps. This approach was effective and allowed the overall new functional layout to be defined in a very short time. The final proposed plan was submitted for approval to the technical office of Milan City Council and the Superintendency for Architectonic and Landscape Heritage. Indeed, like all Italian public buildings over 70 years old, this building has been listed as a cultural heritage asset.

2.3 The Framework of the Technical Issues and the Main Intervention Strategies

The project for the Rinnovata Pizzigoni school complex was developed using a consolidated methodological approach to the restoration of cultural heritage.

All the planned interventions were intended to have a recognizable but muted impact, whereby the constraints imposed by the intrinsic historical value of the monument were respected and, at the same time, the efficiency lost over the years would be restored (The Venice Charter, 1964).

The adopted approach consisted of aiming for maximum preservation of historical structures (Berlucchi, 2018), while adding new elements, preferably using dry technologies (and therefore easily removable and demountable) and concentrating efforts on those parts that had already been extensively reworked or totally lost. The guiding principle underlying the design work was to focus on integrating architecture, structures, and mechanical and electrical installations to yield technical solutions with a simple design and a quiet aesthetic outcome. (Carbonara, 2003; MiBACT, 2018).

The first phase of the project that involved the school, the "knowledge-gathering phase", required an investigative effort to systematize and interpret data from different areas of diagnostics for architectural restoration. The purpose of this first step was to take a snapshot of the current state of conservation of the complex, but also to build up an accurate and detailed historical record (Musso, 2016).

A complete architectural survey was carried out by laser scanner, with the performance of detailed assessments using a navigable and interrogatable model based on a point cloud (Barber et al., 2006).

Fig. 4 Farmer's house

Historical-archival research allowed us to reconstruct the main phases in the construction of the complex, but above all to identify in detail the historical finishes and decorations in some areas of the complex, thanks to a rich and valuable historical photographic archive made available by the Opera Pizzigoni Foundation. The period photographs and archival documentation allowed us to carry out a targeted diagnostic survey of the structures and their internal finishes, thus minimizing both expenditure on diagnostics and disruption of school activities. Continuity in the activities of the school was guaranteed during the design phase and will be guaranteed during the construction phase.

The inspections revealed, in addition to the need to rationalize the use of space, some critical issues relating to the state of conservation of the buildings. A detailed map was put together of changes in the facades, which are in brick, decorative cement (Giola, 2009) and serizzo antigorio (Fig. 6): mainly surface deposits, crusts, biological decay, gaps and cracks (Figs. 7, 8, 9 and 10).

All the roofs displayed extensive signs of leaking, certainly due to the technique used to build them - they are formed by a series of wooden structures and Marseilles tiles without any type of waterproofing—but also to a lack of regular maintenance over the years. This has caused the deterioration of part of the wooden roofing structures, also damaging the attic floor (partly in wood and partly in brick and concrete) and, consequently, the ceilings of all the spaces in the school which bear evident stains of moisture and, in some cases, portions of plaster have peeled off.

The architecture of the buildings, designed to ensure a synergistic relationship between the indoor and outdoor environments within the children's education, has large windows which, together with the absence of thermal insulation, cause significant thermal dispersion from all the surfaces of the casing (Figs. 11 and 12). Very high ceilings lend great airiness to the indoor spaces, but they also represent substantial volumes to be heated and cause annoying phenomena of internal reverberation of sound. The interior spaces require general maintenance; the toilets are outdated and in poor condition; the technical systems are outdated and now need to conform to current fire prevention regulations.

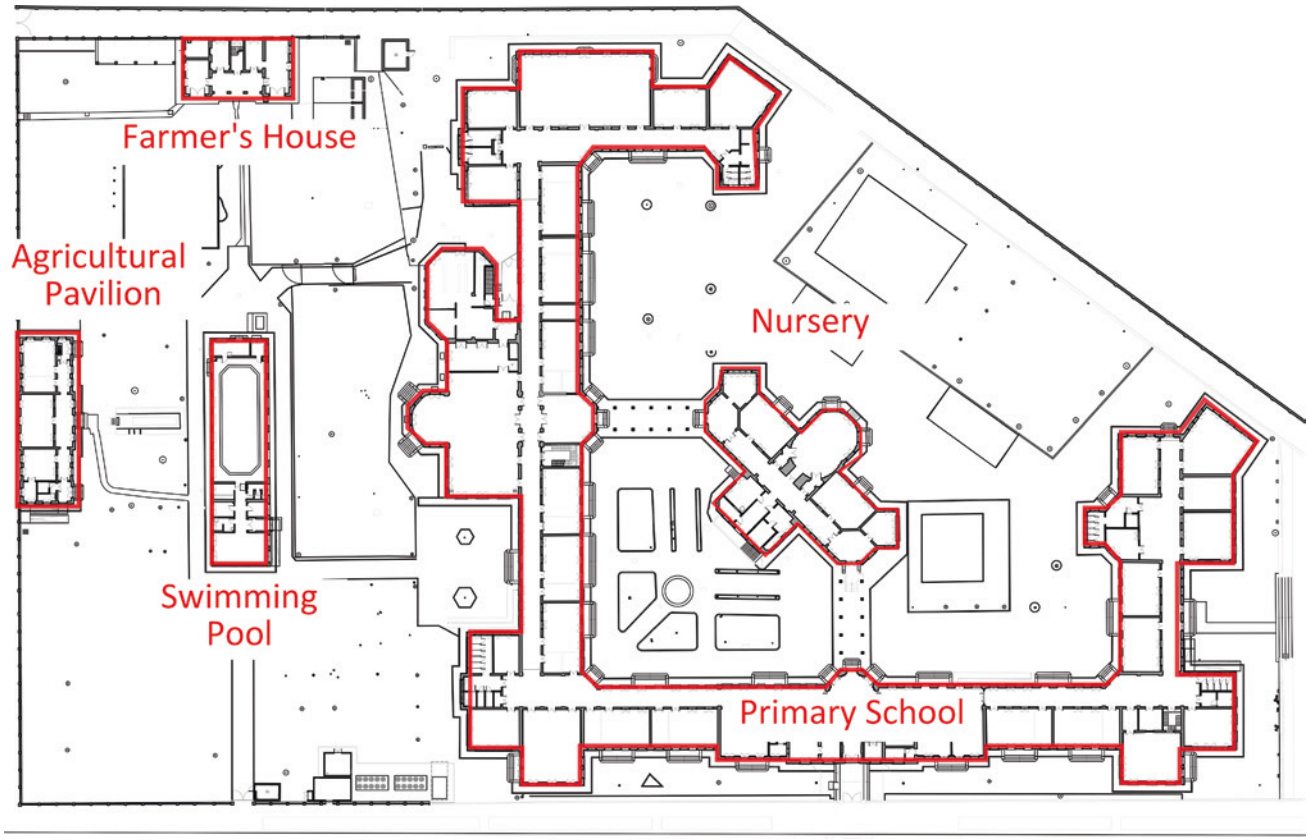

Fig. 5 Overall plan of the school complex

Fig. 6 Sample map of alterations to facades (UNI, 2006)

The structural diagnostics pointed up some critical issues that will be resolved via an overall intervention aimed at improving the buildings' seismic performance. The diagnostic testing of finishes (chemical-physical and stratigraphic investigations) brought to light, in some school spaces, meaningful original decorative stencils and mezzofrescoes (Menicali, 1992). The mapping of the floors showed that the cement finishes of 1927 have mainly been preserved, while the systematic cataloguing of the windows identified several phases of replacement and the need to adapt the glazed surfaces to the minimum current safety standards. Another aspect to be improved is the accessibility of the school to vulnerable users, including blind people.

3 Results

3.1 Preservation and Innovation in the Functional Layout

In the main building, the most important decisions concerned the representational spaces and classrooms. Specifically, it is planned to reorganize Giuseppina Pizzigoni's personal office and make it into the principal's office, while the Pizzigoni hall will be used for meetings and performances as in the past, with interventions to improve the acoustics and air conditioning.

Fig. 7 Biological alteration

Fig. 8 Expulsion of the iron cover

Fig. 9 Lack of bricks

Fig. 10 Lack of mortar joints

Fig. 11 Typical classroom in the Rinnovata Pizzigoni

Classrooms were at the core of the group reflections, in relation to improving their overall condition and solving the present difficulties. The original layout included twenty classrooms, each with doors to the outside and a cloakroom nearby (Figs. 13 and 14). Over time, these accessory spaces were assigned different functions, losing their relationship with the classrooms, and many of the latter are now undersized by current standards. It was therefore decided to reconnect cloakrooms to classrooms by knocking down the partition wall, to increase the available area and allow more flexible layouts, as is expected in innovative learning environments.

Then, a debate took place about the classrooms now located on the first floor (with no direct access to the outdoors) as a consequence of the increase in the number of classes. Although, no proper solutions were found to relocate them to the ground floor, accessibility will be improved via the installation of an elevator in the stairwell and modification of the layout, thanks to extra space gained from the original caretaker's living quarters. Finally, all other available environments not planned to be used as classrooms will continue to be used for educational activities as dedicated inter-cycle spaces with different functions and set-ups (singing room, multimedia room, library, etc.).

Fig. 12 Typical corridor in the Rinnovata Pizzigoni

The agricultural pavilion (see Fig. 3) is a single-storey building with a basement. Originally intended for activities relating to the educational farm, it has over time taken on the broader function of an experimental scientific laboratory. Also in this case, the requests of the teachers were taken on board, leading to the partial reconfiguration of the internal layout (to enhance functionality and bring it into line with standard measurements for labs), and new laboratory furniture and equipment.

Finally, special attention was paid to the former Farmer's House (see back Fig. 4), a two-storey pavilion with a porch, a loggia and a narrow stairwell that precluded the installation of an elevator without severely impacting the building. Here, an educational service for adolescents and the Historical Archive of the Pizzigoni Opera in Milan are located; the latter occupies two rooms on the upper floor and is protected by the Ministry for Cultural Heritage and Activities. The renovation project envisages the redevelopment of some underused spaces on the ground floor, which are to be annexed to the archive to facilitate the conservation and exhibition of the collected materials and to ensure barrier-free access to interested scholars and schools.

Fig. 13 An example of the former cloakrooms

3.2 Technical Solutions for Restoration and Upgrading

The architectural characteristics of these buildings are repetitive, especially in the primary school. It was thus possible to draw a typological section (Fig. 15) that included the main interventions foreseen in most of the building. The roofing issues will be addressed by inserting a layer of waterproofing. Structural consolidation will also be carried out.

Energy dispersion will be reduced on several fronts. The bottom surface of the floor in the basement (which mainly houses electro-technical systems) and the extrados of the roof slab will be insulated. A counterwall applied internally to the perimeter walls will not only provide greater thermal comfort but also hide the electrical system, thus removing the need to cut into historic masonry. These counterwalls, placed on some of the partition walls between classrooms, will also be useful for sound insulation purposes. The windows will be replaced for the most part with new wooden windows with thermal breaks and the shutter boxes will be properly insulated.

Fig. 14 The nearby classroom

The historical flooring in concrete tiles will be restored. The internal doors and windows will also be restored and all glass panes will be replaced for safety reasons.

The radiator heating system currently present, now obsolete, will be replaced in the classrooms with a radiant ceiling system that will ensure adequate levels of comfort for children. The radiant ceiling, which is also sound absorbing, placed at 4.10 m in height and above the shutter boxes, will mask the system that regulates the exchange of air in the classrooms, the fire resistance protection of the ceiling (consisting of a plating in calcium silicate), and the tie rods that serve for structural consolidation. The work on the false ceiling will be preceded by the stripping out of all the existing systems, false ceilings (present in some areas) and ceiling tiles in straw and plaster, which have been irreparably damaged by infiltrations of moisture. This operation will also allow the conditions of the wooden slab between the ground floor and the attic to be verified. On the first

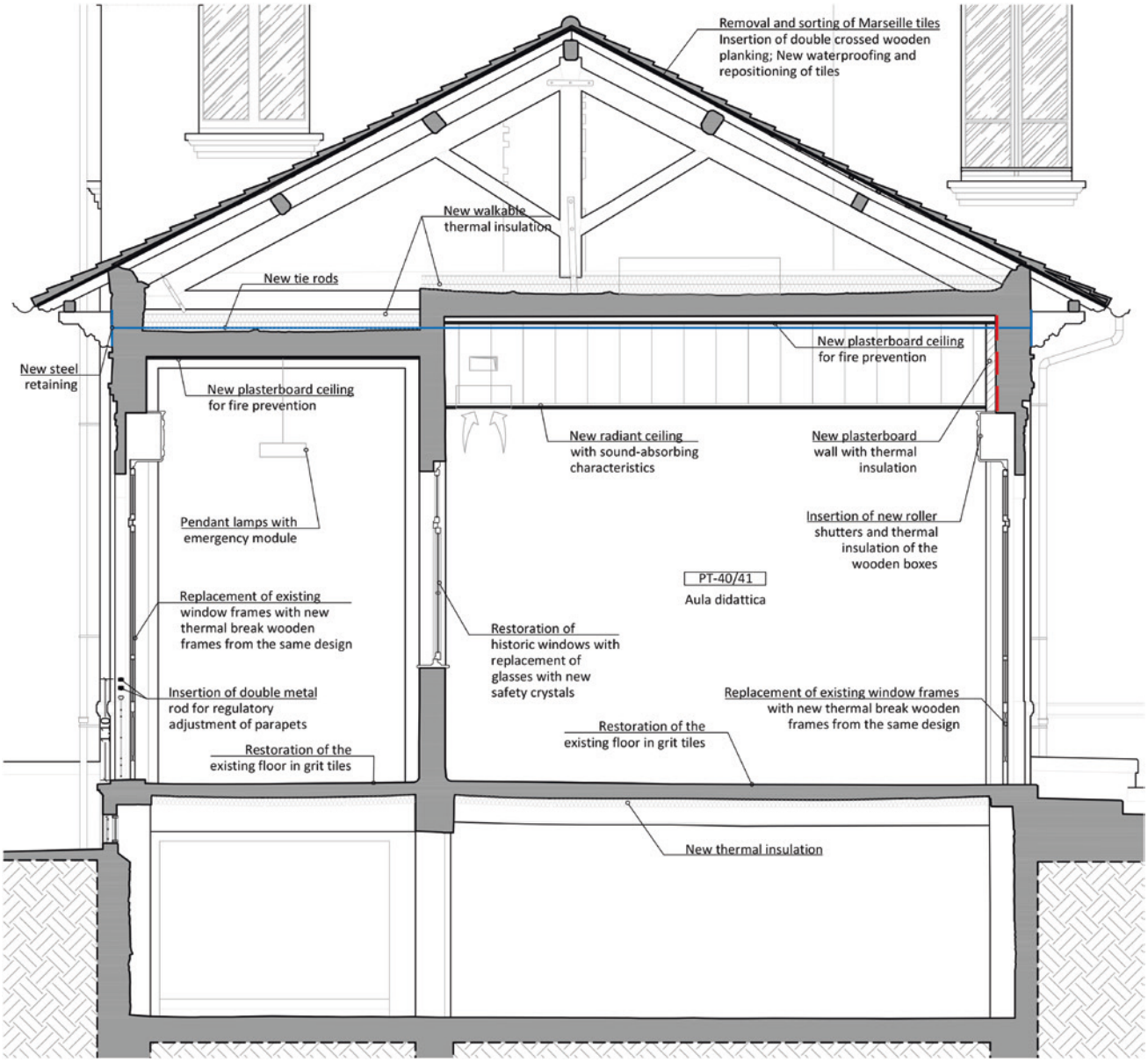

Fig. 15 Typological section of the interventions

floor, given that the ceilings are not high enough to install a radiant system, the floors will be disassembled, catalogued, and properly cleaned, a radiant system installed by milling it directly into the screed, and the floors put back in place. The corridors, where people are not expected to stay for long periods, will keep the historic heating system, but with new heaters. The only two spaces where the various systems will be visible are the refectory and the gym, because the architecture of these spaces, with pillars and coffered ceilings in concrete, and with a vaulted pavilion, respectively, does not allow effective masking. Therefore, a visible solution was chosen, with microperforated channels, which can be made of any colour.

Conservative restoration themes.

The technical expertise brought to bear and the diagnostics carried out on the main building facilitated the identification of a wing where many elements of the original architecture are preserved: the floors in concrete tiles are almost all well preserved; the restorer's stratigraphic essays detected (in the masonry of the corridor) a geometric decoration that changes abruptly just before the refectory; the surviving groove windows still have the original closing systems.

This portion of the building will be subjected to a conservative restoration intervention (red areas in Fig. 16). Specifically, the windows will be restored, except for

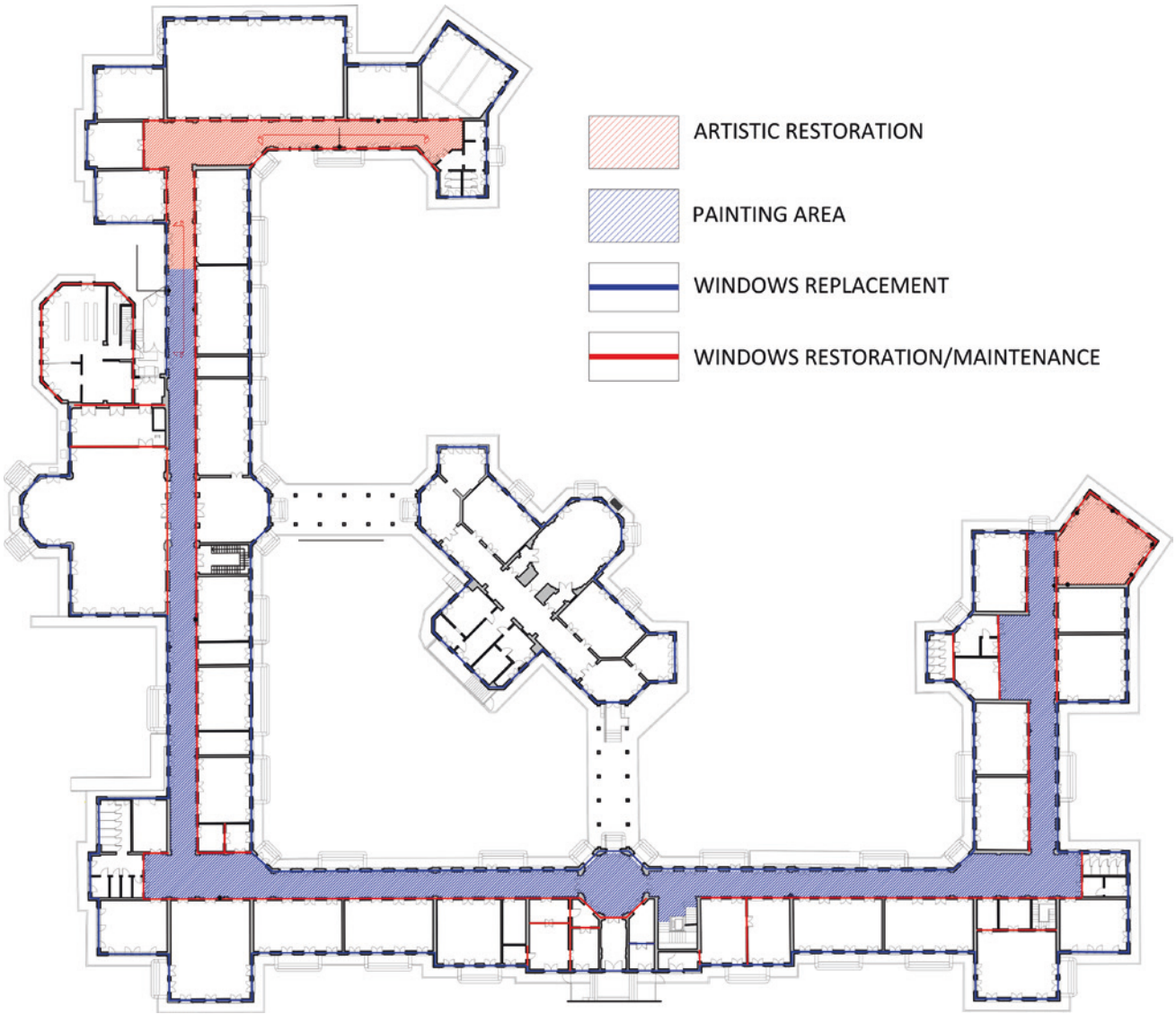

Fig. 16 Restoration project: synoptic table of the restoration of internal surfaces and windows

specific situations in which they were already replaced or bear too much damage; the decorations in the corridor will be restored, following the removal of the white paint covering, and connected with the subsequent decoration which—in contrast—will be replicated on top of the current finishing layers (blue areas in Fig. 16).

In the long corridor, the transition between the area selected for restoration and that selected for replication of the decorations will occur at the point where the stratigraphic essays identified a change in pattern (Fig. 17).

The investigations brought to light a valuable decoration under the white paintwork in one of the classrooms (Figs. 18 and 19), which was once used for the laboratory of plastic design. Here too a conservative restoration intervention will be carried out.

Because all the internal decorations are covered with a layer of white paint, the restoration techniques envisaged in the project will necessarily first be trialled on a sample surface. Following careful removal of the paintwork, which will be done manually with scalpels and small hammers. After the removal, all surfaces will be cleaned using a manual dry cleaning technique with brushes and wishab sponges. Then, different kinds of consolidation techniques will be applied: micro-injection of mortars, if the painted surface detaches from the plaster base, and localized application of ethyl silicate using brushes, if the paint film is pulverized. The cement grouts will be removed and replaced with new compatible mortars. The artistic reintegration of the paintings will be executed according to the principle of distinguishability of the intervention. In the

Fig. 17 Restoration project: photographic simulation of the connection point of the two decorations

Fig. 18 Historical image from Archivio Storico Opera Pizzigoni (AF442)

Fig. 19 Stratigraphic test

presence of geometric or architectural shapes, the aim will be to reproduce the volumes via the main geometrical lines. The replacement of plastic elements will be evaluated on-site in order to identify the most suitable way to mitigate the lacunas.

The facades, mainly in brick with decorative concrete basements (in the main building, Fig. 1) and in serizzo antigorio stone (in the agrarian pavilion and farmhouse, Figs. 3 and 4), and a plastered band on top, will undergo conservative restoration, as will the numerous staircases in serizzo.

The restoration work on the facades is summarized in the overall map of the alterations and interventions (see Fig. 20 and also Fig. 6) that lists the alterations, by material. Thus each type of batch is associated with a single sequence of restoration processes that makes it measurable and costable..

In relation to the top band, the integrity and adherence of the plaster will be verified manually and any portions to be peeled off will be identified. The surface will be cleaned using a low-pressure hydrowash technique in combination with manual cleaning. Eroded and peeled portions of plaster will be consolidated via the localized application of ethyl silicate. The cracks will be opened and cleaned and the boundaries will be consolidated. The replacement of the plasters that are removed, and that already missing, will be effected using new plaster with new mortars whose chemical-physical characteristics are compatible with the historical mortars. A final lime glaze will be applied to soften any discontinuities.

The masonry also requires a general cleaning of all surfaces via low-pressure hydrowashing and manual techniques, preceded, where necessary, by the application of a broad-spectrum biocidal treatment spray and manual removal of shrubby vegetation. The masonry displays various alterations that need to be addressed. Missing bricks in the curtain wall will be replaced with others similar to the original ones, recovered from the construction site itself, if possible. Missing mortar joints will be addressed by conducting in-depth manual cleaning of the joints and grouting them with new mortars that are compatible with the historical ones. Cement patches will be removed and replaced with compatible materials and saline efflorescences will be removed using localized compresses with deionized water.

The decorative cements will be treated similarly to the plasters, with the due differences in the chemical and physical characteristics of the restoration mortars. In addition, black crusts will be removed using ammonium carbonate compresses. The restoration mortars should have thixotropic properties, in particular in the reintegration of small losses in volume (mainly in cornices with simple geometric outlines), following the insertion of stainless steel pins. Where the infiltration of moisture has compromised the reinforcement irons and clearly rusted them, before any replacement is carried out, they should be thoroughly sanded, blasted and primed with protective products.

The stone elements mainly comprise ashlars above the windows, the skirting in the Farmer's House and the Agricultural Pavilion which is made of serizzo antigorio, staircases, and entrance slabs. For these elements, it will be necessary to verify their degree of adhesion to the masonry and to resolve any issues identified with a new bonding using suitable and compatible mortars, following thorough cleaning of the elements. The principal cleaning system will be low-pressure hydrowashing followed by manual cleaning techniques. Where areas of scaling or erosion are present, ethyl silicate will be applied locally using brushes. In the case of deposits that are particularly difficult to remove, compresses soaked in ammonium carbonate will be applied.

Architectural barrier themes.

Addressing architectural barriers was another key theme explored during the design process The technical solutions required to satisfy the guidelines issued by Milan City Council for the design of signals and tactile paths for users of the complex were adopted, while also taking into account the buildings' protected status as cultural heritage assets and the type of users that would actually be the beneficiaries.

Fig. 20 Map of alterations, materials, and interventions on the principal façade of the Farmer's House

DECORATIVE CEMENT		Decorative concrete surfaces with surface deposits, flows, encrustations and stains of various nature	CD 01	1. Cleaning by removal of consistent surface deposits by low pressure water washing and manual completion by broom brushes, sprayers and sponges 2. Removal of consistent deposits and scaling by ammonium carbonate tablets 3. (if any) Consolidation of the portions eroded by ethyl silicate applied by brush
		Decorative concrete surfaces with surface deposits	CD 02	1. Cleaning by removal of consistent surface deposits by low pressure water washing and manual completion by broom brushes, sprayers and sponges 2. Reintegrations and small grouting by mortar with similar chemical-physical characteristics and compatible with the existing ones
		Superficial lesions and micro-cracks	CD 03	1. Crack opening and removal of all consistent and inconsistent surface deposits by manual cleaning with broom brushes, sprayers and sponges 2. Edge consolidation through the application of ethyl silicate and mortar compatible with the existing 3. Reintegration and grouting of lesions by mortar with similar chemical and physical characteristics compatible with the existing one
		Losses of decorative concrete elements and improper patches	CD 04	1. Deep cleaning using brushes and sprayers of the area to be replenished, removal of all surface deposits and inconsistent materials. 2. (if any) scarifying, blasting and passivation of oxidized reinforcement irons, accurate manual cleaning. 3. Reintegration of missing molded parts by applying mortars compatible with the existing one, including the use of stainless steel or epoxy resin pins.
		Biological patina	CD 05	1. Application of broad spectrum biocidal treatment, spray or brush applied, for two cycles 2. Cleaning by removal of consistent surface deposits by low pressure water washing and manual completion by broom brushes, sprayers and sponges 3. Localized consolidation by brush application of ethyl silicate

Fig. 21 Extract from the restoration legend

The design was therefore based on the assumption that paths for the visually impaired would most likely be needed by visually impaired adults (e.g., parents) who attend school occasionally. Children (up to 10/11 years of age) cannot in any case make independent use of these paths and must necessarily be assisted by school staff. Taking into account all these factors, maps and tactile plates are envisaged only where strictly necessary, and primarily for use by visually impaired adults (mainly in selected classrooms, the offices, and the Pizzigoni hall). Together they will form an LVE route that extends to the kindergarten pavilion. This path will be in PVC and glued onto the existing flooring to ensure its preservation.

4 Conclusions

The architectural restoration of a complex such as the Rinnovata Pizzigoni, built as a school and still used today as such, raises numerous technical and technological issues, given the need to adapt the structure to new increasingly stringent regulations and new uses and needs associated with contemporary life. The in-depth study of this complex has pointed up the great practicality inherent in Giuseppina Pizzigoni's thinking, including in terms of how she guided the design of spaces for her school. The result was a forward-looking architecture that can be updated to cater for contemporary needs without distorting its historical-artistic and functional features. About 100 years after its construction, the Renovated Pizzigoni school still contains all that is required to carry out school activities today, with five more classes than originally foreseen. The techniques used to construct it and the simple but extremely effective technological original solutions such as the ventilation guaranteed by a large basement, as well as the well-aired spaces (with ceilings up to six meters high), have now made it possible to replace all the electro-technical systems with modern equipment that offers contemporary standards of indoor comfort, without sacrificing the size of the spaces, but rather now exploiting spaces that were previously underutilized.

From the point of view of the restoration of the indoor surfaces, it was necessary to find a meeting point between the effective everyday use of school and the need to tell the story of this complex. On the one hand, it was fundamental to consider the intensive use of the buildings, and on the other hand, the highly evocative potential of some of the spaces. Hence, the artistic restoration of some portions of the building, while taking into account how they are used, as well as the need to optimize public spending on school buildings. In the future, however, it will be possible to expand the areas of artistic restoration to other parts of the buildings, given favourable circumstances.

Finally, following the participatory process, the school staff reported that their thinking about school spaces had greatly expanded, from their previous focus on the areas they used themselves directly (their own assigned classroom or laboratory) to a more general vision of the entire school environment, as well as aspects such as the movement of classes from one space to another, the usability of internal and external space, and so on. In sum, the participatory trajectory drew the attention of the members of the school community to the specific dimension of Giuseppina Pizzigoni's approach that combines educational thinking and the design of spaces, allowing them to share their experiences and needs and steer the definition of transformative actions.

The paper is the result of multidisciplinary work undertaken by the authors. Nevertheless, Sects. 1 and 4 were edited by Maria Fianchini, Franca Zuccoli, Nicola Berlucchi and Flavia Mainardi; subsection 2.1 was edited by Franca Zuccoli; subsections 2.2 and 3.1 were edited by Maria Fianchini; subsections 2.3 and 3.2 were edited by Nicola Berlucchi and Flavia Mainardi.

References

Baird, G., Gray, J., Isaacs, N., Kernohan, D., & McIndoe, G. (1996). *Building Evaluation Techniques*. McGraw-Hill.

Barberm, D. M., Dallas, R. W. A., & Mills, J. P. (2006). Laser scanning for architectural conservation. *Journal of Architectural Conservation, 12*(1), 35–52. https://doi.org/10.1080/13556207.2006.10784959

Berlucchi, N. (2018). Il restauro del moderno. Spunti e domande. In A. Morelli & S. Moretti (Eds), *Il cantiere di restauro dell'architettura moderna. Teoria e prassi* (pp. 31–38), Nardini Editore.

Carbonara, G. (2003). *Trattato di restauro architettonico. Restauro architettonico e impianti*. UTET.

Fianchini, M. (2019). Scenarios under change in school facility interventions. In M. Fianchini (Ed.), *Renewing middle school facilities* (pp. 3–15). Springer.

Fondazione Giovanni Agnelli. (2020). *Rapporto sull'edilizia scolastica*. Editori Laterza.

Giola, V. (2009). *Cementi decorativi liberty. Storia, tecnica, conservazione*. Edizioni Quasar.

MiBACT Ministero dei Beni e Attività Culturali (2018). *Le Linee guida del MiBACT per gli interventi con energie alternative nei centri storici*. Betagamma editrice.

Musso, S. F.(2016). *Recupero e restauro degli edifici storici. Guida pratica al rilievo e alla diagnostica*. EPC Libri.

Pizzigoni, G. (1914). *Indicazioni per la costruzione della "Rinnovata" rivolte al progettista ingegner Erminio Valvert.* s.e..

Pizzigoni, G. (1921). *La scuola rinnovata secondo il metodo sperimentale*. Tip. Luigi Luzzatti.

Pizzigoni, G. (1931). *Le mie lezioni ai maestri delle scuole elementari d'Italia*. Rinnovata, Ufficio di Propaganda.

OECD. (2019). *Analytical Framework for Case Study Collection Effective Learning Environments*. https://www.oecd.org/education/OECD-FRAMEWORK-FOR-A-MODULE-ON-THE-PHYSICAL-LEARNING-ENVIRONMENT.pdf.

UNI Ente Italiano Di Normazione. (2006). *Beni culturali Materiali lapidei naturali ed artificiali Descrizione della forma di alterazione - Termini e definizioni*. (UNI 11182). https://www.uni.com.

Watson, C. (2003). Review of building quality using post occupancy evaluation. *PEB Exchange, 1*(48), 15–18. https://doi.org/10.1787/715204518780

IInd International Congress of Architects and Technicians of Historic Monuments, Venice. (1964). *The Venice International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter 1964)*. https://www.icomos.org/charters/venice_e.pdf.