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The Learning Factory

An Adaptive Reuse of a Former Factory in Bologna for the New Headquarters of a University for Applied Arts and Design

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Abstract

The Learning Factory is a private university for Applied Arts and Design located in Bologna, Italy, in an early twentieth century complex along the railway. The spaces, due to their past use related to the production of hand-decorated tiles, are characterized by large zones with a marked verticality, which the renovation project has maintained and enhanced. Beneath its ripples, the pitched wooden roof forms a sort of covered square with a program open to the various activities of the university. Closed standard classrooms colonize some of the available spaces, hybridizing with flexible classrooms and shared spaces, which represent over half of the available internal area. Large windows divide the classrooms from the other spaces, allowing a visual connection between the people involved in the various didactic activities. Flexible study spaces are part of the connective space, creating an osmosis relationship with it, and a high degree of space adaptability, both during students' activities, as well as for presentations with external guests or cultural events. The change in urban use of the new spaces requests a seismic structural adaptation of the entire structure: a new steel frame layer integrates the existing brick walls and the wooden roof, creating new geometric and material relationships with the existing. The mechanical building systems represents a new visible layer in the space conceived to react differently according to the architectural elements with whom it creates a relationship. The Learning Factory: a new university that recovers an old factory without occupying new land, generating an articulated space informed by flexibility for innovative teaching, through large and adaptable shared environments. A contemporary university playing the role of a civic center for the local community with an open program of activities, as natural complement of the didactic experience.

Keywords: Adaptive, Learning, Sharing

Introduction

The Learning Factory—a private university for applied arts and design is located in Bologna, Italy, in a complex along the railway that originally housed the early twentieth century *Ovidio Vignoni* hand-decorated tile company. The complex was converted and divided into various lots in the early 2000s, occupied by activities related to the world of creativity, art, design and crafts. The spaces still retain their early twentieth century industrial identity, which various renovations have preserved. The location, on the edge of the historic center, just a

few dozen meters from the train and bus stations, is particularly strategic and integrated into the city's public transportation system.

Existing Building Enhancement and Adaptive Reuse Interventions

The main entrances of the complex are on the ground floor, accessible from the public streets, via *Jacopo Barozzi* and *Attilio Muggia*. The total indoor surface of the single-story building is 1800 square meters, the differences in level between the various internal spaces never exceed forty centimeters and there are no basement floors.

Two mezzanines, one on the north and one on the south side, are part of the building: the first one is accessible via a staircase and a steel walkway in the central space, while the second one is reachable using a staircase in one of the offices on the south side of the building. Two patios are located in the most central part of the complex, in order to provide light and air to the spaces, in combination with the sky windows. Exposed brick masonry characterizes both the facades and partially the internal walls. The floors are finished with concrete, and the roof has timber features such as trusses and ridge beams to support the secondary structure. The adaptive reuse project aims to translate the indications derived from the principles and guidelines into a framework that complies with standard regulations (structures, plant systems, health and hygiene aspects, local building regulations, fire prevention, safety) and adapts to the characteristics and constraints of the spaces.

The indoor spaces, due to their former use linked to the artisan and production sector in the field of hand-decorated tiles, are characterized by large zones with a significant verticality, that the expansion project maintains and enhances. Beneath its ripples, the pitched wooden roof forms a sort of covered square with a program open to the various activities of the university. Closed standard classrooms colonize some of the available surface, hybridizing with flexible classrooms and shared spaces that represent more than half of the available area. Large windows separate the classrooms from the other functional areas, allowing visual communications between the people involved in the various didactic activities.

A contemporary approach to the design of learning spaces must create environments in which a spread of mutual visibility is allowed, that facilitates visual interactions between the various subjects in the different learning places. Most of the activities take place on the ground floor, in continuity with the external spaces of the city. The reduced height differences between the various zones are connected by a system of ramps with a regular slope that draw on the industrial imagination and are placed in the spaces as points of

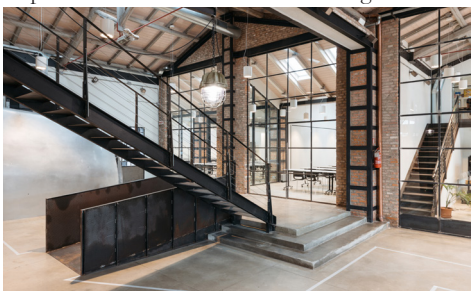

Fig. 1. The Learning Factory. The visual permeability of the exposed "masonry wing" of the complex (Photo by Massimo Nicolino, 2020)

reference and orientation. The two existing mezzanines for specific functions, such as offices and meeting rooms, are integrated with a new one in the east wing, connected by a light and iconic yellow staircase made of perforated steel panels. A new raw steel spiral staircase integrates the vertical connection of the offices on the west side mezzanine.
The flexible study spaces—characterized by reconfigurable walls, screens composed of suspended curtains and movable furniture—are part of the connective space, creating a relationship of osmosis with it. This solution allows a high degree of space adaptability, both during moments of study and exchange between students and on the occasion of presentations with external guests or cultural events: in this way, an open and active space is created for learning. The exhibition spaces, equipped with wall supports and areas for exhibiting prototypes, represent an active cultural device within the university, integrated with the shared areas (Groves, Marlow 2016). The contents on display, coming from the didactic productions of the various departments and by external curators, stimulate the debate around the different topics investigated by students' design projects. The space is divided into two wings connected by the central patio; every wing serves different uses, so the appearance of the materials and surfaces is distinct. The aim of the project is to enhance the identities by finding coherence in the use of colors and materials. The high quality of the masonry in the west wing enables it to be extensively revealed, matching the carbon-colored steel structures. In the east wing, the massive presence of good white plaster surfaces and wide windows facing the road lead to a more ethereal effect, also turning the new anti-seismic steel structures white. Only the central columns, wrapped by the new anti-seismic steel cages, have exposed bricks. The new restrooms are designed as a tribute to the industrial simplicity of the previous manufacturing function.

An Active Environment for a Design Community

Teaching spaces are increasingly being used to create community around knowledge: an intangible binder, which requires open methods, motivated teachers, and flexible spaces that can be adapted to various educational and functional programs.
A community that gathers around knowledge rethinks its spaces, as soon as it has the opportunity (Weiland, Attia 2015). In preparation for the architectural design phase, a workshop was organized with students and teachers to rethink together the new learning spaces. Nine groups of students, coming from the five design departments (Interior,

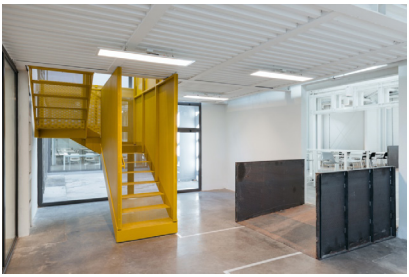

Fig. 2. The Learning Factory. Ramp and staircase connecting the different levels (Photo by Massimo Nicolino, 2020)

Fig. 3. The Learning Factory. Flexible learning spaces in the "white wing" of the building (Photo by Massimo Nicolino, 2020)

Communication, Product, Fashion, Transportation), produced visions in a co-design experience, which informed the initial phase of the architectural project. The co-design process had three main moments:
a) The collective debate from which the strengths, weaknesses, opportunities, and threats of the analysis topic emerged. A SWOT assessment matrix was produced: strengths as strategic location for public transportation (railway station, bus station, bicycle station) and services (proximity to the city center); network of spaces and services in the city (Fab Lab, library, cultural institutions, businesses); identity and quality of spaces; flexibility of common spaces for various activities; thermal comfort of spaces (winter - summer). Weaknesses are related to the reduced acoustic comfort in some shared teaching spaces; to restricted spaces for study activities and lunch breaks; to the lack of on-site printers. In the field of the opportunities the expansion project is seen as a way to increase shared spaces and acoustic comfort in the renovated classrooms, to integrate outdoor spaces and new shading systems for windows. The main threat is referred to the vehicular traffic in the area that generates noise and reduces safety for pedestrians and cyclists.
b) Groups were engaged on the following topics during the workshop: teaching spaces (classrooms and laboratories); shared spaces (indoor and outdoor); break times (lunch, breaks between classes, study time); equipment (monitors, interactive whiteboards, tablets, software, furniture); the relationship between the Learning Factory and the city of Bologna (opportunities on mobility, services, cultural offers).
c) The questionnaire, completed by each student, on the actions and impressions that characterize a typical day in the university.
All the results of the initial co-design experience were considered in the architectural design process, as part of the brief, inspiring the flexible program in the numerous shared spaces. An open environment where to exchange mutual knowledge and to activate relationships able to go beyond the mere professional and academic role. Students are encouraged to confront, to take responsibility for their role and to horizontally exchange experiences and knowledge between themselves and towards teachers and staff.

A Place for an Active Learning Attitude

Learning environments are both physical places and mental and cultural spaces, in which learning takes place through the combination of rational and emotional processes.
According to *Gianni Marconato*, an environment of this type is a rich, redundant place, with an open program, sometimes even dissonant and chaotic (Marconato 2012). And it is precisely this articulation of possibilities that makes the space adaptable to the different real situations in which the training process develops. Excessively rigid spaces, inspired by a standard functionalism, prevent the delicate learning process from taking shape.
The document "School Building Guidelines", promoted in Italy by the Decree of the Minister of Education, University, and Research, in agreement with the Minister of Infrastructure and Transport, and the Minister of the Environment (11-4-2013) in the chapter "I.1 Learning Spaces," provide a clear definition of this principle: "Today, there is a growing need to view the school as a single, integrated space in which microenvironments dedicated to diversified activities have equal dignity and are habitable and flexible, capable of accommodating people and school activities at any time, offering functionality, comfort, and well-being. [...] Connective spaces become relational and offer different modes of

informal activities, whether individual, in small groups, or in groups".
Space is considered by theorists and pedagogical specialists to be one of the most powerful devices to generate learning in students. According to the Dutch master *Herman Hertzberger* a school can be an effective architecture for learning. He summarized this method in four points: first of all, going beyond the "classroom-corridor" relationship increasing the articulation of spaces and distribution; as second aspect the "threshold" spaces - shared and flexible intermediate spaces that are among the most codified; then the "home base" classroom - a reference point from which to open up to multiple learning spaces; the "learning landscape": shared and flexible spaces for individuals or small groups (Hertzberger 2008). The Learning Factory project accepts the challenge of the classroom paradigm transformation, proposing the overcoming of the "class-corridor" relationship, towards a "learning landscape" articulated and full of meanings, capable of adapting to changes and hosting the individual, as well as the group.
The body, learning methods, and spaces are profoundly intertwined. Learning is related to movement and the different bodily postures, reacting to the activities in various spaces: medium to long-term attention in classrooms, individual or group concentration in study areas, conviviality in shared facilities, and the action of transforming flexible spaces. Learning architecture takes these aspects into account, and teaching spaces must embrace these nuances to become community spaces, social environments where knowledge and curiosity are at home, while maintaining their formal mission (Weiland 2014).
With technological development, in particular the digital revolution, a new way of thinking has developed, therefore also of teaching and learning (Weyland 2014). How technologies – through wi-fi networks, laptops, projectors, interactive and connected monitors, equipment for Virtual Reality and Augmented Reality, Artificial Intelligence and robotics tools – influence the spaces in which we live and train is one of the issues to be addressed in the coming years. The knowledge infrastructure needs multifaceted and flexible spaces to enhance the multiple intelligences of students (Gardner 1983). The nine intelligences analyzed by *Gardner*, in addition to specific educational programs, require structured and interactive spaces that stimulate their development, especially the most restrained ones.

A Contemporary Civic Center

Not only a university, but also a place for production of ideas in dialogue with the context—a contemporary civic center for the local community with an open program of activities as a complement to the didactic experiences. The civic center role has a dual importance: engaging the community of people (students, staff, faculty) and, on the other hand, promoting mutual exchange between active communities for the urban context in which it is located. On a larger scale, the school's civic role is expressed by becoming a point of reference for the network of businesses in the various sectors represented by the departments: a network of excellence that gravitates around the new Learning Factory headquarters. Various communities can find their own environment in the Learning Factory: those characterized by a serial use of spaces (students, staff, teachers) and the occasional ones, expression of the city and the territory, attracted by dedicated events. The university, since the first months of its establishment in Bologna, promotes and organizes events alongside education (during Bologna Design Week and the Art Fair), firmly believing in the multidisciplinary nature of knowledge. It positions itself as a civic center right from

the start, thanks to the adaptability of its spaces, the active community of students and the lively surrounding context.

Seismic Structural Adaptation

The main load-bearing structure of the building is entirely masonry (walls and pillars). The pitched roof features a main timber framework consisting of trusses supporting the trim and ridge beams.
The change in urban use of the new spaces requires a seismic structural adaptation of the entire structure. The seismic retrofitting interventions include the insertion of steel frames to absorb seismic loads applied to the existing masonry and wood structures, which continue to carry vertical loads (permanent and variable). The new retrofit structures will be active during a seismic event. The foundations of these new structures are constructed partly with inverted beams (direct foundations) and partly with plinths on micropiles (indirect foundations).
The architectural project integrates the anti-seismic structures in the general design, giving them a spatial and geometric meaning, establishing a new relationship with the existing elements of the interior space. A new steel layer underlines the roof wooden structures, the brick pillars, and the masonry walls, creating real portals when necessary, as in the east wing of the building. Structural portals are also shaped to integrate the exposed ventilation pipes.

Mechanical Building Systems

The renovation maintains the significant verticality of the spaces, emphasized by the lighting system that integrates old industrial lamps and luminaires with contemporary performances. Photovoltaic panels are integrated on the south and west slopes of the roof to partially cover the energy needs of the building.
The heating system fits in the space peculiarities, using radiant floors to optimize the vertical stratification of the air and exposed pipes for the mechanical air ventilation sized according to the number of users. Mechanized air exchange and treatment in areas where people are present (classrooms, study and exhibition areas, offices) is integrated with natural ventilation through controlled renewal systems capable of ensuring the minimum required air exchange, using heating and ventilation systems, cooling, and heat recovery systems to supplement needs.
The mechanical ventilation systems - as required by the UNI 10339 standard, in order to guarantee acceptable levels of well-being for people while balancing the need to reduce energy consumption - ensure: outside air intake following the minimum levels based on the room's intended function; minimum air filtration; air movement at speeds within specified limits. All this is done to maintain adequate thermal, hygrometric, and air quality characteristics in the space conventionally occupied by people.
For heating and cooling, the west wing spaces are equipped with a radiant flooring system, powered by a gas boiler and heat pumps integrated with air dehumidification units. The east wing spaces have an air system powered by an existing diesel heating system and an electric refrigeration unit.
The mechanical building system represents a new visible layer in the space, as for the seismic retrofitting structures, conceived to react differently to the architectural elements with whom it creates a relationship. The architectural design interprets the adaptive reuse

of the learning spaces with creativity and sensibility, applying as needed both the strategies of expressive visibility and presence in filigree.
The Learning Factory acts as a new university building that recovers an old factory without occupying new land, generating an articulated space informed by flexibility for innovative teaching, through large and adaptable shared environments. The project represents an opportunity to apply some principles of innovative teaching to a series of existing spaces, considering users—students, teachers, staff, citizens—as a real interactive community in progress.

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Fig. 4. The Learning Factory. Anti-seismic steel structures integrated with the architectural elements (Photo by Massimo Nicolino, 2020)