Adaptive Environments. New Spaces for Learning

Gianluigi Mondaini and Marco Rosciani

Abstract The architecture of schools can no longer be as rigid as it has been in the past. It needs to be spatially open, stimulating and, through its physical qualities, able to react and adapt to those who live and work there to use it as an active educational tool. However, architecture by itself is not enough to define new spatial models for education or for our society and its ever more complex problems. Thus, a plurality of forms of disciplinary participation is necessary. Pedagogy, with its close relationship with architecture, and technology, with the innovations it brings to teaching methods, are also involved. The dynamism in communication processes and educational practices that arises from new technologies demands a review of how school environments are organized, along with flexible, multifunctional and adaptable solutions for them. The most interesting models are those in which the conventional classroom “breaks down” physically, in favor of open-space learning environments, and flexible spaces. Such layouts help promote skills acquisition, thanks to the synergy between the technological elements and the physical qualities of the spaces that make learning more engaging.

Keywords Open space · Learning spaces · Technological environmental

1 Learning Environment

In recent years, we have witnessed a change in direction in the design of learning spaces within the scene of school architecture that is leading, also in Italy, to buildings that are designed with more attention on the relationship between the built space and learning. This reversal in trend stems largely from the will of institutions to keep pace with the changing needs of contemporary education and standards of quality of

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school building, which still see us lagging behind especially in relation to Northern Europe.

The first steps in the initiative were the studies conducted by the Ministry of Education, University and Research (MIUR) with the support of the scientific research conducted by the INDIRE agency. In 2013, INDIRE produced guidelines for school buildings, with the goal—so far unattained, unfortunately—of updating the legal framework established in the Ministerial Decree of 18 December 1975. Hence, the strategic recommendations are for designing attractive and stimulating spaces, based on a concept of school as a multifunctional hub, through a shift in design towards spatial “generosity” and an innovative relationship with context [1]. A spatial openness that can interpret social change, leaving behind the typological standardization that has been repeated for many years and has led to the symbolic irrelevance of the building within the community.

The space will no longer be made of walls alone, but also by the people who animate, interpret and modify it with their presence and creativity in the didactic process. The architecture of schools can no longer be as rigid as it has been in the past. It needs to be spatially open, stimulating and, through its physical qualities, able to react and adapt to those who live and work there to use it as an active educational tool.

The main subject of discussion is certainly the classroom: a paradigm of the past tied to the system of mass literacy, that has hardly changed over the years and now it no longer suits the needs of a more advanced school system, where teaching methodologies are more focused on the personalization of programs and teaching. Yet, architecture by itself is not enough to define new spatial models for education, since the issues are becoming increasingly complex. What is needed is multidisciplinary participation: pedagogy, with its close relationship with architecture, and technology, with the innovations it brings to teaching methods. One interesting proposal is INDIRE’s “1 + 4 learning spaces for a new generation of schools in Italy”. The institute intends to use this space model to open up the classroom to a new configuration, in which four complementary spaces are placed on a par with the class’s group space, rather than being subordinate to it: the individual area, which is the student’s personal space, the informal space for relaxing and meeting others, the exploration space, where students can learn to make, and finally the agora, the community space [2]. Each of these spaces requires suitable technological equipment, from individual personal devices, such as tablets and notebooks, to interactive tools and immersive virtual environments for managing teaching; digital manufacturing laboratory equipment requires intensive, widespread technological infrastructure designed in an integrated way with architectural elements.

The models that are being pursued are those of the most avant-garde schools in northern Europe, where we are witnessing the physical disintegration of conventional classrooms in favor of open-space learning environments. One example of this is the work of Danish architect Rosan Bosch, who describes his own principles of learning landscape design, with the creation of open and flexible environments aimed at a better acquisition of skills, thanks to the synergy between the technological elements and the physical qualities of the spaces that make learning more engaging [3]. By

Fig. 1 Rosan Bosch Studio: Vittra Telefonplan, Stockholm (2011). From learning environments to learning landscape

analyzing planimetric developments in Swedish Vittra schools (Fig. 1), we see the physical freedom of the teaching spaces, in which the classroom disappears and the organization of space is governed by functional activities; spaces are equipped with digital technologies, which can adapt to the needs of students, following a logic of “reversed” didactics, the *flipped classroom* [4], or *cooperative learning* [5], aimed at improving educational interactions. Further design and technological developments can be found, with the built space evolving towards a more “nuanced” meaning. An architecture that is less physical and leaves room for technological interactions, and integration between real objects and virtual elements, with the potential to transform the learning landscape.

2 Research and Project Experiences

The workshops in the Scientific School Innovative Learning spaces, organized by the University of Sassari, produced several experiments, which led to a series of interesting reflections on the theme of innovative spaces for learning. These involved experts from various disciplines ranging from architecture and technology to pedagogy. Both of the experiences we present concern interventions on existing buildings, which came about from a desire to dismantle the static relationship between the classroom and the corridor, by using multifunctional architectural devices.

The first case concerned a secondary school in Sassari, which, although built only ten years earlier, was functionally, spatially and architecturally inadequate, far from the current needs of pedagogy. We came up with a functional review of the classroom that imagined a new relationship between the interior and the exterior of the building, but especially between the classroom and distributive space.

To do away with the fixity of the didactic spaces, partitions were replaced with sliding walls, equipped with interactive technology (Fig. 2). The classroom space thus leaves behind its original boundaries and becomes a dynamic setting, where learning experiences are also had in more informal areas, and much-needed dialogue is restored between different sections [6].

Fig. 2 Middle school extension project, Li Punti, Sassari. Team: M. Ferrari, C. Tinazzi, G.M. Dettori, M.M. Fiori, M. Lucesoli, A. Lucidi, D. Perrotta, M. Rosciani, (2016). Classroom concept, with extension of the teaching activities into the distributive space, thanks to a mobile wall system, and into the outdoor space

The second case concerned a historic, early twentieth-century building, with a rigid spatial layout, marked by the classroom–corridor sequence. The project seeks to recreate a less formal environment, aiming to hybridize learning and distribution spaces with the aid of a “parasite” element (Fig. 3). This is a spatial device that extends progressively from the horizontal plane onto the walls; a new “kitted out skin” that builds a continuous learning landscape that extends beyond the physical limits of the wall partitions, dislocating the various teaching functions over a wider area.

Another research experience that is similar to the one just described arose from the collaboration of the UNIVPM DICEA Department with Circolo Didattico “San Lazzaro” in Fano. This is a concrete opportunity for intervention within the National Plan for Digital Education, which envisaged the design of a creative workshop within a Montessori primary school.

The objective was to combine the old ceramic workshops and the adjacent science lab into a “maker space”, one single creative environment, where experiential teaching can be applied to increase students’ skills and competences in an engaging and participative way.

The first stage in the project involved demolishing a partition wall between two classrooms to create a single space. Next, we added modular furniture which, depending on how it is combined, can be used as workstations for computers and making activities, or can change configurations as needed to provide new spatiality to suit different didactic requirements, based on what work is being done and what devices are being used.

Fig. 3 Sacro Cuore School, Alghero. New learning landscape project. Team: G. Mondaini, L. Cabras, A. Dessì, E. Melis, M. Sotgiu, B. Zaru, (2016). The new architectural device for the hybridization of learning and distribution spaces

Fig. 4 *Atelier Creativo*, Montessori Primary School, Fano. Team: G. Mondaini, M. Rosciani, M. Tellechea, (2017). Design concept and images of the implementation

We used the same module for the wall that divides the classroom from the corridor; this time it was a case of subtraction, to create transparent openings and visual continuity between the interior and the exterior of the new atelier. Outside the laboratory, in the wide corridor, the furnishing elements can be used to display the works produced and can also act as “islands” for gathering and relaxing (Fig. 4). The workshop is also used by the community during non-school hours, particularly for preparations for the town’s carnival.

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