

Chapter

Reactive Spaces: Space as a Tool for Self-Education

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Abstract

Self-regulated learning, a cornerstone of modern education, is frequently hindered by traditional educational space designs. This issue is particularly pronounced in Italy, where outdated school buildings, many dating from the 1970s, fail to support contemporary educational needs. These “learning boxes” limit student engagement and do not accommodate the dynamic nature of the human mind. Instead, educational spaces should be reimagined as dynamic environments that integrate learning into daily life, fostering interaction and discovery. Maria Montessori emphasised the importance of environments that educate, advocating for adaptable, multifunctional spaces that promote spontaneous activity and peer collaboration. A “breathing school” today transcends simple physical structures, leveraging technological innovations to enhance learning experiences. By integrating digital tools into educational spaces, we can create dynamic and engaging environments that overcome spatial limitations. Our research proposes a multidisciplinary and participatory approach, involving architects, educators, and neuroscientists to create “open” learning environments that support authentic learning experiences. This study aims to transform schools into stimulating educational spaces that adapt to evolving needs, ensuring flexibility, sustainability, and architectural quality. By uniting architecture and pedagogy, we can design schools that better serve society, promoting active learning and well-being.

Keywords: self-regulated learning, dynamic environments, multidisciplinary approach, adaptive architecture, digital integration

1. Introduction

Self-regulated learning, a key concept in contemporary education, often encounters obstacles in the architecture of educational spaces. This issue is particularly pronounced in Italy, where the outdated school infrastructure accommodates millions of students every day. Many school buildings, especially those constructed in large numbers since the 1970s, are often designed according to obsolete paradigms that see the classroom as the pivotal element of the architectural typology interpreted as a simple “learning box.” These spaces limit the receptive and expressive potential of students, neglecting the complexity and dynamism of the human mind. A static and exclusively rational design of educational environments can inhibit the learning process. Conversely, it is essential to rethink school spaces as opportunities, where studying becomes a dynamic experience integrated into daily life. In this new perspective, “learning” becomes synonymous with

“living,” as individuals encounter, create, and interact in environments that foster the discovery and construction of knowledge.

We would like to start this discussion with the Latin etymology of the term “inhabit,” which derives from the verb “habitare.” This verb, in its turn, comes from “habitus” past participle of the verb “habere” meaning “to have” or “to possess.” Thus, “inhabit” in the Latin context connotes not only the simple act of residing in a place but also implies a sense of possession, familiarity, and custom with one’s surroundings. Our schools should therefore be inhabited, and all students should have familiarity with a place that is not only physical.

Maria Montessori, an educational pioneer, had already stressed the importance of an “environment that educates” [1], promoting polymorphous, transformable, and multifunctional environments that facilitate spontaneous activity and collaboration among peers. Montessori, in theorising her educational method, placed great importance on the architecture of the environment in that it will be “this type of environment that will perform the function of ‘teacher,’ of life and culture since it allows spontaneous activity and thus stimulates active and constructive development through a process not of instruction but of self-education” [1].

Our research offers a design approach to the architecture of educational spaces that is multidisciplinary and participative, combining the expertise of architects, pedagogists, and neuroscientists. The goal is to identify themes, experiment with forms, and develop models for “open” environments that breathe and let breathe, meeting the needs of authentic and meaningful learning. This study aims to provide useful pointers for transforming school spaces into places that not only host education but also stimulate it and make it an integral part of students’ daily lives.

In summary, to build schools that truly serve today’s society by contributing to the formation and realisation of its future, it is necessary to combine architecture and pedagogy in a continuous and productive dialogue. This is the only way to create educational environments that are flexible, sustainable, and able to adapt to future changes.

This new multidisciplinary approach will be articulated in the following paragraphs, where we highlight the benefits of collaboration between different sectors. The need to rethink Italian school architecture emerges, centring design on spatial quality and recognising the influence of the environment on student learning and well-being. The integration of architecture and pedagogy, historically disjointed, is explored as essential to creating educational spaces appropriate to modern needs.

The “Senseable Space” concept is introduced, which explores the use of digital technologies to make educational spaces more interactive and adaptive, enhancing the sensory experience and well-being of students.

The second section proposes creating school environments that go beyond mere functionality, promoting multisensory engagement and a sense of belonging. Finally, the paper proposes a participatory and interdisciplinary approach to school design, emphasising the use of sustainable technologies and materials and the importance of flexible and customisable spaces that meet contemporary educational needs.

2. State of the art

The School Building Report published in 2020 by the Agnelli Foundation, which offers policy directions for the necessary interventions in Italian school buildings in the coming years, concludes unequivocally: “Italian school buildings are no longer

adequate. They are lacking from two essential points of view: as physical structures and as spaces for good teaching, both now and in the near future” [2].

Given the demographic decline, many buildings could be demolished or replaced due to their current spatial and technical inadequacy for the educational purposes for which they were designed. Today, considering the necessary revision and adaptation to contemporary education, these buildings can be reimagined by placing spatial quality at the centre of design action, now recognising the influence of the environment on student learning and well-being. A space must be able to embody and disseminate the values of community, functionality, energy performance, and, above all, the increasingly rare quality and beauty, and it must become an educational vehicle through its recognisable performance capacity and formal quality.

In recent decades, the meaningful integration of architecture and pedagogy has rarely occurred. These two disciplines, each with its own historical background and mutual autonomy, have followed parallel paths but rarely intersected, especially in the case of the reuse of pre-existing structures. “For centuries, school architecture has used forms developed for other purposes; initially gymnastic, then religious, and later even industrial, bringing from each the rigidity of structures designed for the management of processes or practices that didn’t allow any degrees of freedom” [3].

Architecture and pedagogy, however, have operated on different timelines; the former, with its enduring constructions, has managed to survive changing social functions, while the latter, being more sensitive to societal changes, has had to adapt more rapidly. This discrepancy has resulted in school buildings that are often inadequate for contemporary educational needs.

In Italy, the absence of a national strategy for school construction has caused considerable disarray, leaving many school buildings in need of renovation and improvement. Since the postwar period, there has also been a failure to consider schools as key elements in urban regeneration processes, thereby missing the opportunity to transform suburbs into places of experimentation and innovation. This oversight has distanced school buildings from their users and from their recognisability as public buildings capable of fostering collective identity.

The rigidity of many schools often fails to harmonise with the constant evolution of teaching methodologies and the adoption of criteria aimed at environmental sustainability. It is paradoxical that schools, places where new generations are educated, are not at the forefront of expressing these principles.

Targeted interventions can transform school buildings into spaces that not only meet educational needs but also represent added value for the community, becoming catalysts for urban regeneration and sustainable growth. Such interventions should not neglect architectural quality, emphasising the important symbolic role that schools should play.

3. Space as a cardinal tool of self-education

3.1 Senseable spaces

Taking as an example the theme and meanings of the term “Senseable City” [4] coined at MIT by Carlo Ratti (the next curator of the Venice Architecture Biennale 2025), which explores how digital technology can improve urban life by making cities more sustainable and liveable, we can articulate the concept of “Senseable Space” as a series of physical spaces made “smart” or “sensible” using digital technologies.

Contemporary educational spaces, through technological devices such as sensors, can collect, analyse, and respond to data in real time, improving the interaction between people and their surroundings. The goal is to create more efficient, comfortable, and adaptive environments. In a senseable classroom, it is possible, for example, to create user interfaces that allow people to interact with the space naturally and intuitively through voice commands, gestures, or mobile applications, or for the space to automatically adapt to users' needs and preferences, such as adjusting lighting, temperature, or furniture arrangement.

Technology and shape must find common ground in finalising the design of the space by experimenting with concrete applications of the "senseable space" concept. This space must be capable of reacting both through its form and technology to the emotions and needs of the human body in the environment.

Pallasmaa, in his best-known writing, "The Eyes of the Skin" [5], states that "every architectural experience is tactile and multisensory"; just as a "walk in the woods invigorates and heals through the constant interaction between all sensory modalities," it is necessary to promote an approach to architecture that enhances the full sensory experience and creates spaces that engage and enrich all the senses, offering a deeper and more meaningful experience of the built environment. In this way, architecture can "strengthen the existential experience, the sense of being in the world."

According to Pallasmaa, at the centre of space is the human body. This assumption is even more relevant when the body in question is that of a child. A child compares the space he experiences with his own body: his legs measure the lengths of the space, his gaze unconsciously projects his body onto the walls of the classroom, the weight of his body meets the architectural masses that make up the everyday space he experiences, and he compares himself with them. The child discovers himself in the space he inhabits, and the space itself exists through his experience: "the city and my body integrate and define each other. I dwell in the city and the city dwells in me" [5].

The architecture of learning spaces should therefore be experienced through physical and sensory, not just visual, interaction capable of engaging the whole body. The senses work together to create a multisensory memory of space. These sensory memories influence our imagination and how we perceive and remember architectural environments. Spaces that engage multiple senses can stimulate students' interest and curiosity. Multisensory environments, with varied textures, pleasant sounds, and agreeable smells, can make learning more engaging and memorable.

To echo Pallasmaa, as analysed by Matteo Zambelli in his critical anthology of essays by the renowned Finnish architect [6], it is important, especially in school environments, to define the concept of atmosphere. Atmosphere is described as the perceptual essence of a place, what makes a place unique and unrepeatable. It is a set of sensory and emotional qualities that influence the human experience of space. Atmosphere can be influenced by various factors such as light, sounds, smells, temperature, and human interaction, transforming space into place.

For our schools to contribute indirectly to the learning process, they must transform from learning spaces into true "educating places": the classroom should not be considered in its purely physical and geometric dimensions, as a kind of neutral container that can be measured and quantified independently of human experiences. Rather, it must become a "Place": a space dense with meaning, transformed both by its physicality and by human experiences, stories, and relationships, loaded with emotional and cultural values, becoming a point of identity reference for people.

School architecture is thus not just a static backdrop but a leading actor interacting with those who inhabit it. Its conscious design considers not only functional and aesthetic aspects but also emotional and atmospheric dimensions. Steven Holl, in his conceptual book “Parallax,” which investigates the relationship between architecture, discoveries in science, and perception, speaks of architecture as a “catalyst for change” in that it “has the subtle, yet powerful, ability to shape our everyday experiences in terms of material and detail. When sensory experience is intensified, psychological dimensions come into play” [7].

The intensification of sensory experience is particularly crucial during school age, as well-designed learning environments can stimulate the senses, improve concentration, promote emotional well-being, and support students’ cognitive and social development.

To ensure the success of spatial innovation, it is also essential to invest in a robust technological infrastructure. This includes the installation of powerful wireless networks, access to reliable digital devices, and the creation of well-equipped technology labs, especially for science-technology and art-expressive experiences. Additionally, to prevent purchased technologies from going unused (a risk of the new funding operation to purchase digital devices under the National Recovery and Resilience Plan (PNRR)¹), it is important to provide ongoing technical support and training programmes for teaching staff to maximise the use of new resources.

Sustainability and maintenance issues are also crucial: long-term planning is needed to ensure the durability of these innovations from the outset. Choosing technologies, resources, and furnishings that are easily upgradable and adaptable to new needs, alongside preventive maintenance programmes to keep equipment in excellent condition over time, is essential. Involving students in maintenance operations could incentivise the development of a sense of active citizenship, promoting respect and care for their environment.

The use of natural materials such as wood and stone can foster a welcoming and relaxing environment, while innovative materials such as smart glass and acoustic movable walls allow spaces to be modulated according to educational needs. Sustainable and recycled materials not only reduce environmental impact but also teach students the importance of sustainability. Additionally, the integration of writable surfaces and interactive technologies into the walls and furniture stimulates creativity and interaction between students and teachers. These elements, combined with optimal natural lighting, good ventilation, and the use of colours that promote well-being, help create healthy, versatile, and up-to-date learning environments.

3.2 Forms and spaces around a new “knowledge hub”

The latest guidelines in a long series of national actions, unfortunately, all lacking incisiveness in Italian policy, were developed with the help of renowned Italian designers and were introduced in 2022 by Minister Bianchi. These guidelines envision future schools as “catalysts of urban life, centres of sociality, and places capable of

¹ Piano Nazionale di Ripresa e Resilienza – National Recovery and Resilience Plan, is the strategic plan developed by national governments, to address the socio-economic challenges resulting from the COVID-19 pandemic.

promoting important values through an implicit pedagogy of architecture: sensitivity to the environment, equal opportunities, social inclusion, intellectual engagement, openness to an increasingly connected world”².

These guidelines are intended to guide design action but face difficulties due to outdated legislation (still adhering to the 1975 Decree-Law) and a lack of awareness of the urgency for innovation. This urgency highlights the need for forms capable of stimulating curiosity, fostering discovery, and promoting self-determination in those implementing the regenerative process.

The active participation of all stakeholders in both the analytical and design phases allows for greater sensitivity in compositional imagination and demonstrates the potential of space, whether existing or new, interior or exterior, as a possible tool for education. The design of new schools and the regeneration of existing ones must consider the renewed educational needs and desires of all those who inhabit these spaces, ensuring they provide effective learning environments where individuals feel comfortable and in harmony with their communities and surroundings.

These spaces must stimulate activities and emotions, empathetically engaging both individuals and groups, creating a school environment capable of extending beyond the classroom walls, the building’s perimeter, and its physical boundaries. This approach builds an architecture that, as our slogan states, “breathes.”

Most school buildings, especially those constructed in the last quarter-century and comprising most of the building stock, have spatial configurations based on linear cause-and-effect logic. This means that the form of such spaces is determined by the specific functions for which they were designed, limiting their adaptability to other uses.

Both pedagogical and neuroscientific research has shown that ignoring the complexity of the human mind and bodily experiences in space design inhibits learning. Since space is a fundamental aspect of human experience, it is crucial to rethink school spatialities with open forms that provide opportunities where “learning” equates to “living.” In these spaces, individuals can meet, do, create, and be. Only in this way do spaces acquire meaning, becoming existential and lived reference points, where qualities prevail over quantities and actions are synergistically supported by the material realities.

To be educational, space must be surprising, arousing curiosity, and stimulating discovery and engagement with both the world of knowledge and others sharing the same space and experience. It is necessary to move away from the functionalist model implicit in often outdated legislative regulations, which imposes spatial dimensions and configurations oriented towards rationality and rigid organisation. This model promotes linear, disciplined, and hierarchical learning that no longer aligns with the complexity of current society.

For space to be self-educating today, it needs to be fluid, open to various combinations, and therefore modifiable, almost a tailor-made space, adaptable to different groups of students who may vary year by year or even group by group. A customisable space meets different needs, using the space itself as an educational partner.

² Ministry of Education of the Republic of Italy, Futura. Designing, building and living the school, PNRR Internal Guidelines, 2022. Working group composed of Arch. Massimo Alvisi, Arch. Sandy Attia, Arch. Stefano Boeri, Arch. Mario Cucinella, Dr. Andrea Gavosto, Arch. Luisa Ingaramo, Prof. Franco Lorenzoni, Dr. Carla Morogallo, Arch. Renzo Piano, Dr. Raffaella Valente, Arch. Cino Zucchi.

The rigid dimension of the closed corridor-lecture hall model, with spaces until recently incommunicable with each other, is now being challenged by introducing laboratory spaces and larger areas for meetings and sharing among students and with the surrounding urban spaces, such as the agora. This paradigm needs to be completely revolutionised towards a conception of experiential space, where transparency represents the metaphor for the necessary and free interconnection of knowledge.

For us, the slogan “a school that breathes” embodies an open thinking model in a spatially dynamic dimension of learning, allowing for a new relationship between school and city. This aligns the concept of transparency and openness of learning with breaking down its metaphorical and physical enclosure [8].

The “school breathing” is an educational environment where everyone, from children to adults, can traverse and experience space, engaging in activities that facilitate knowledge sharing. By integrating the city and welcoming people, it creates urban spaces, both outdoors and indoors, where individuals can come together and experience moments of collective life. The breathing school is like a sponge, absorbing all available opportunities and offering diversified educational experiences integrated with open spaces.

The connection with the innovative and seemingly utopian theme of the “educating city” focuses on urban organisation and distribution and on relationships between school buildings and between schools and the city that encompasses them. It aims to extend learning modes beyond traditional school boundaries, requiring an integrated vision considering both urban and pedagogical aspects. This vision is designed to actively engage citizens of all ages and create an environment fostering informal learning and social development [9].

Using images, which are strategic in both the design and teaching professions, to convey concepts and visions, we should move beyond the concept of an island—a closed and perimeter school—to the concept of an archipelago, where educational units project into the city beyond the traditional enclosure. This approach, through various poles spread throughout the city in strategic and thematic locations, allows students to understand the concept of belonging to a broader, plural dimension. It also stimulates young people to anchor the knowledge they have learned in the real world and enhance their self-determination.

To reshape the space of learning, “breathing” must mean going beyond the usual physical dimensions of the classroom or building and utilising the digital dimension as a multiplier of knowledge possibilities. This involves developing new conceptions of space and technological innovation, imagining forms, dimensions, and techniques that go beyond mere repetitive acquisition of devices, instead integrating them with architecture for a new nature of educational space. Improving the integration of teaching and technology requires fast connections and enhanced digital skills. Education can bridge this gap by introducing new, innovative spaces within buildings, promoting immersiveness, connection, and transparency.

Most of Italy’s existing school heritage is outdated and unable to meet current needs for comfort and energy efficiency. Design strategies to upgrade these buildings to modern standards can also serve as educational opportunities, fostering the essential sensitivity students need to face future challenges.

For new school building design, it is crucial to initiate a participatory process involving all stakeholders—from those making political decisions to build a new school, to those designing it, to those who will experience it as teachers or learners. Participation is essential to make the entire community aware of the need to prioritise quality and innovation in every choice and intervention. New open architectural

morphologies capable of stimulating self-learning should be at the centre of these considerations. The form, with all its physical, technical, and material components, becomes a sensitive environment for the user, playing a central role in well-being and learning, embodying Loris Malaguzzi's well-known concept of a "third teacher." [10].

Imagining a building that helps stimulate and convey knowledge involves relating multiple factors, both material and immaterial. As human beings, we are products of our environment: the form and quality of a building significantly influence our education.

Steven Holl, a contemporary and sensitive architect, during an interview after a recent Italian conference ("Looks on Matter: the Truth of Making between Architecture and Art," June 27, 2024, House of Architecture, Roman Aquarium, Rome), related form, matter, and art, calling architecture the "conductor of an orchestra of a symphony of elements." He further stated, "today, real luxury is health, given primarily by the relationship between the individual and the environment on which they depend. Architecture that respects natural space produces an environment conducive to human well-being" [11].

3.3 A holistic approach to transform school spaces into active learning environments

Innovative learning environments are critical in the evolution of education today, integrating knowledge transmission with digital technologies, interactivity, and active student engagement. These environments promote inclusivity, personalise the educational journey according to students' individual needs, and encourage interaction.

The evolution of school facilities has been gradual and uneven, influenced by various political, social, geographical, cultural, technological, and educational factors. However, in recent decades, there has been a growing awareness of the importance of active learning and the need to create flexible school environments. Architecture has not always adapted to these educational initiatives, as obsolete buildings managed by local governments often fail to recognise architecture as a meaningful "partner" for learning and have not envisioned projects to rehabilitate existing structures to accommodate new needs.

Traditional classrooms, with rows of desks facing the teacher's platform, have been replaced in some institutions by spaces that allow for collaborative learning, experimentation, and the use of advanced technologies. These changes reflect evolving theories of learning and a growing awareness of the need to prepare students for a rapidly changing world.

Today, architecture alone is not sufficient to develop new spatial models appropriate to the complexity of society and its challenges. It is essential to involve multiple disciplines to effectively address these issues.

Beate Weyland, associate professor at the Faculty of Education at the Free University of Bozen, stresses the importance of a multidisciplinary approach and promoting participation as key tools in the design phase. However, given the increasing diversity of actors involved and the complexity of the issues at stake, participation should not be seen as the main decision-maker in the design process. This role lies with the project itself and its ability, through its formal choices, to coordinate and synthesise the various components involved [12].

Before outlining space design and technology infrastructure, it is essential to conduct a thorough needs analysis involving the entire school community to fully

understand the school's requirements. This is the first step towards a successful project. Assessing connectivity needs, accessibility to digital resources, and staff training is critical to a smooth transition to an innovative learning environment.

Once the needs are understood, the design of spaces can proceed, focusing on flexibility and collaboration to encourage active and personalised learning. The layout of classrooms, the choice of furniture, and the creation of adaptable work zones must reflect the dynamic nature of new teaching methodologies. The skillful integration of open spaces, group work areas, and reflection zones promotes more engaging learning. New architectures for education emerge in which space, following the Montessori concept, takes on a primary role and becomes a "teacher," fostering communities of practice³, stimulating innovation, and making the school environment enjoyable.

The transition from traditional school buildings to open and innovative learning architecture is crucial and can often be achieved at low cost. Innovation often depends more on vision, policy choices, and architectural research than on resources, challenging functional conventions to redefine proposed spatialities. In this spatial transition, environments beyond the classroom become crucial. Corridors, often lacking spatial and social identity, can be repurposed. The distributive space in front of classrooms, along with chosen furniture, assumes a central role not only during breaks but also during learning, accommodating collective, autonomous activities, and personalised interventions. These spaces can host discussions, meetings, rest, or individual study, returning underutilised areas to the school community and appropriately sizing them to innovative intentions.

The classroom itself transforms from a rigid space, symbolising outdated transmissive teaching, into a system capable of hosting different configurations and connecting to neighbouring spaces. Groups of classrooms can be aggregated and made to communicate, offering multifunctional indoor and outdoor environments, organically connected with the rest of the school and intended for various collective activities. Movable wall systems between classrooms are among the first solutions implemented to meet diverse educational needs, offering ever-changing and dynamic configurations essential to a school that promotes integration, complementarity, and interoperability.

Material choices are a separate but integrated theme. Beyond performance in terms of safety and health, materials are essential for stimulating perception and knowledge. Matter and colour, known for their ability to stimulate physical empathy with space users, can convey feelings and emotions when properly juxtaposed and designed for school environments. Texture and colour allow for the recognition of differences through the senses and help even those with perceptive and sensory difficulties to orient themselves in space.

Another important aspect is investing in multi-purpose and multifunctional spaces, considering both environmental and financial sustainability.

The transition to innovative learning environments in schools is not without challenges. Local government budget constraints could be overcome through strategic planning aimed at maximising investment effectiveness. Identifying priorities and establishing implementation phases can facilitate more efficient use of financial resources. Partnerships with the private sector could also be envisaged, potentially leading to sponsorships and donations that alleviate financial pressure.

³ A community of practice, as defined by Étienne Wenger, is a group of people whose goal is to foster personal and professional development through the exchange of experience and knowledge.

4. Conclusions

In today's globalised world, cities offer endless experiences and emotions to all citizens, and schools can open up to the outside world in two ways: by using cities as training environments and social spaces, or by providing their facilities to the community through the organisation of services outside school hours.

Implementing the school-city connection with a Europe-wide perspective of transforming the school into an “open system”—where all educational components of the community (families, associations, recreational facilities, and the world of work) participate, sharing co-responsibility for education—is the right approach. The school can position itself as a bridge between the “inside” and the “outside,” becoming an active community, open to its surroundings, a “school that breathes.”

To give the school a new identity and transform it into a true architecture of education and self-learning, new visions are emerging that see the school as an attractive centre for everyone, a community space accessible to all for cultural exchange and intellectual pursuits. It is important to make use of all areas within the school building for learning, exploration, research, and discovery of cultural resources together. Connections between environments should be enhanced, and movement should be considered a key element to promote learning and civic awareness [13]. Movement and active participation, not only in encounters with others but also in the management and transformation of the student's daily environment, customisable to their needs and desires, are central to the discussion above and the focus on which architectural proposals for a new school capable of shaping the citizens of the future must revolve.

Movement means identifying and experimenting with open and fluid forms capable of rapid space transformation. It is important, as stated in the essay, that formal design and technological innovation work in synergy to meet this challenge of a new dynamic and active spatiality that stimulates, in the directions listed, a new education through a sensitive environment capable of stimulating learning itself. A complex future awaits us, and both the space surrounding us and the space in which our students spend much of their time must be equipped with the many technological innovations available. These technologies include increasingly efficient home automation and, above all, innovative artificial intelligence that could significantly contribute to providing morphological and spatial guidance capable of relating, empathising, and adapting based on algorithms and sets of information that speed up solutions and realisations for efficient environments ready for teaching that is always in step with the times. The role of architecture will be crucial in this transition, designing empathic and philanthropic school buildings to facilitate the new active role of the student and counteract social isolation.

In conclusion, we are also convinced that technology, artificial intelligence, and all other innovations are merely tools, valuable allies of the designer's creativity, and above all, of their alliance with the actors in the educational process. This synergy is indispensable for imagining attractive, comfortable, stimulating, and increasingly adaptable forms and spaces to create schools capable of shaping conscious citizens of the future.

Conflict of interest

The authors declare no conflict of interest.

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