

THE EDUCATIONAL VALUE OF THE BODY'S LIVED SPACE EXPERIENCES IN NEUROSCIENCE, ARCHITECTURE, AND EDUCATION

NEUROSCIENZE, ARCHITETTURA ED EDUCAZIONE: IL VALORE EDUCATIVO DELLE ESPERIENZE VISSUTE DAL CORPO NELLO SPAZIO

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ABSTRACT

The classroom, a container of objects and relationships that has a profound effect on the psycho-physical health and learning of educators and educands and can expand from indoor to outdoor, physical to virtual dimensions, is the archetypal educational space. Education is a transformative activity that strives to promote both physical and emotional well-being. In order to drive progress, it is imperative that barriers that may hinder learning and engagement in unfamiliar or perceived hostile physical-relational spaces are removed. The dynamic and intense interaction between action and context is an illustration of the significant role that learning environments play in fostering school well-being and societal progress (Searles, 1960).

L'aula, contenitore di oggetti e relazioni che incide profondamente sulla salute psico-fisica e sull'apprendimento di educatori ed educandi e può espandersi dalla dimensione interna a quella esterna, da quella fisica a quella virtuale, è lo spazio educativo archetipico.

L'educazione è un'attività trasformativa che mira a promuovere il benessere sia fisico che emotivo. Per favorire il progresso, è fondamentale rimuovere le barriere che possono ostacolare l'apprendimento e l'impegno in spazi fisico-relazionali non familiari o percepiti come ostili. L'interazione dinamica e intensa tra azione e contesto è un esempio del ruolo significativo che gli ambienti di apprendimento svolgono nel promuovere il benessere scolastico e il progresso sociale (Searles, 1960).

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Introduction

Since the early 20th century, the structure and distinctive features of educational institutions have been central to the activist pedagogy advocated by Maria Montessori and Giuseppina Pizzigoni. Montessori's Children's Home and Pizzigoni's *Rinnovata* were distinguished by their open areas, courtyards, and fields that encouraged exploration of the surroundings and manual activities. The underlying idea was to create welcoming atmospheres that would encourage children to express their skills while reducing the sense of dismay and strangeness that typically accompanies entering unfamiliar environments, which are consequently perceived as hostile. Furthermore, in the vein of pedagogical activism during the late nineteenth century, John Dewey, an American pedagogical philosopher,

recounted his struggles with finding desks that permitted children to move around during the establishment of a school workshop in Chicago. At the time, school equipment manufacturers held a preconceived idea that desks were only suitable for still and sitting positions (Pesci, 2017, p.8).

Space influences the formation of thought, and children learn more quickly when they reside in an environment that stimulates their senses, according to Loris Malaguzzi.

The process of *reading* spatial language is polysensory and involves immediate receptors for the environment, such as skin, membranes, and muscles, as well as remote receptors (e.g., nose, ears, and eyes). Due to the reciprocal nature of qualities between the subject and its habitat, both the environment and humans are dynamic and mutually transformative. Both male and female individuals exhibit an exceptionally high level of perceptual, holistic, and polysemous sensitivity and competence. At this stage of life, immediate receptors are at their most active, and their capacity to differentiate reality via sensory receptors other than sight and hearing is demonstrated to be exceptionally high (Bobbio, 2020, p.90).

Therefore, it is important to prioritise the psycho-physical well-being of individuals who will be learning in environments that provide a variety of sensory stimuli. This will encourage children to engage with the space rather than viewing it as a "passing place" or a "non-place" (Weyland, 2021, p.213). Such an environment fosters inclusion and active connection with the territory in which they live.

According to Malaguzzi, an effective arrangement of educational facilities and services for children can also compensate for the deficiencies of families by establishing the connection between education and democracy that Dewey (1916) suggested could transform society through the establishment of *democratic laboratories* for schools. As an environment conducive to the cultivation of talents and potentialities, the school must establish itself in accordance with community canons in order to facilitate the dissemination of talents and enable them to contribute positively to society. Therefore, education must be "useful" to society.

It is not decoupled from the entity in question. School is community in and of itself (Pezzano, 2017; Malaguzzi, 2010), referring to the correlation between learning and space quality, refers to space as the *third educator* in addition to the teacher and peers.

Indeed, space serves as a narrator, clearly describing attitudes and decisions, whether explicit or implicit, and can therefore serve as a potent pedagogical tool to promote well-being (Weyland, 2021, p.211).

2. The intersection of architecture, neuroscience and pedagogy to inhabit the school.

The Academy of Neuroscience for Architecture (ANFA) was founded in 2003 with the intention of bridging the gap between the seemingly distant disciplines of architecture and neuroscience (Canepa & Fassio, 2021).

The fields of neuroscience and architecture converge in their comprehension of and responsibilities towards their shared focus, the corporeal human being. A being that can only exist through relationships: relationships with the environments we inhabit, relationships between individuals, and relationships with the world. Architectural environments possess the ability to either cultivate, weaken, or eradicate these types of relationships (Robinson, 2015, p.14).

Neuroscience is the branch of knowledge that investigates the inner workings of the human brain and the manner in which the nervous system processes sensory information. John Paul Eberhard (2009), architect and president of ANFA, asserts that designers can create spaces that promote human brain adaptation and the well-being of individuals by understanding the influence of environments on human behaviour and mental functioning. In her opening speech at the AIA National Convention in 2003, geneticist Rutsy Gage made reference to alterations in the human brain and behaviour that are brought about by modifications in the environment (Eberhard, 2015).

Research has indicated that the acoustics of educational settings can also have an impact on student performance and the quality of learning (Klatte et al., 2013; Shield & Dockrell, 2008). Particularly during the early years of education, environmental noise not only poses health risks (stress, sleep disturbances, cardiovascular problems, etc.), but also impairs the attention and learning abilities of students. Indeed, neural networks establish an infinite number of connections among the senses; consequently, various environmental factors such as lighting, temperature, olfactory and tactile sensations originating from materials and furniture, as well as the acoustic quality of the classroom, impact listening (Eberhard, 2008).

Neuroscience suggests that the most significant exposure to the stimuli and influences of environmental factors that induce developmental changes occurs

primarily during *critical periods* in infancy.

Indeed, it is critical that sufficient sensory stimuli are delivered within a specified time frame and no longer than that; failure to do so will impede the nervous system's ability to reach its maximum development (Peru, 2011, p. 42).

As a result, it is critical that learning environments be tailored to the requirements of the students who will inhabit them.

The complex task of constructing, designing, and establishing physical or virtual learning environments, establishing architectural atmospheres (Canepa & Fassio, 2021), and illuminating spaces to foster the development of individuals' abilities and potential cannot be entrusted solely to professionals in engineering, surveying, and architecture. This is because the pedagogical decisions and educational undertakings that shape the pedagogical identity of the school environment are also involved.

In addition to failing to promote students' mental and physical well-being, neutral schools, which exclude locations like train stations and airports, fail to exemplify the concept of an educational community where “the city, neighbourhood, and country serve as conducive learning environments” and classrooms that foster an atmosphere that encourages both learning and teaching (Weyland, 2021, p.214). Therefore, learning environments must undergo a transformation into inhabitable spaces that are relationally definable and not assimilated to the non-places referred to by Augè (1993).

Forms of exogenous territorializations, which are products of modernity, are distinguished by the transient nature of their dynamics, the passage of territorial actors, and solitary individualism: individuals move through non-places, yet no one resides there (Aru, 2015, p.70).

Plants in schools, for instance, could be regarded as a *pedagogical gesture* for the following reasons: “engaging in daily plant care, including selecting, nurturing, observing and even playing with it, can be considered as highly instructive actions” (Aru, 2015, p.217).

Play areas are limited or absent in Italian schools (Vitale, 2011) due to the fact that their pedagogical models assign little value to this particular activity. On the contrary, promoting active play among children would aid in their overall psycho-physical development. In fact, a lack of physical activity, particularly outdoor play and sports practise, has been linked by numerous studies to elevated rates of aggression, depression, and antisocial behaviour among youths (Huttenmoser & Degan-Zimmermann, 1995; Stephenson, 2003).

Presently, numerous educational institutions exhibit a lack of responsiveness

towards student needs, featuring plain classrooms that, at an average age of 55 years (Delle Donne, 2022), require extensive renovations and maintenance to ensure environmental sustainability and safety.

Particularly concerning is the condition of educational spaces upon entering secondary schools. It is frequently baffling how it is possible to inspire joy, imagination, and expressiveness while spending so much time in these desolate and barren environments. It is difficult to impart aesthetic sensibility, dignity, taste, and values in such environments (Weyland, 2021, p.216).

Not only during the construction phase, but also during the redevelopment of existing buildings, pedagogy can significantly impact the design of educational spaces by transforming them into places of connection where the identities of the individuals who will inhabit there are shaped and accommodating the needs of the educating community.

Outdoor Education is a pedagogical proposal that is interesting. Enhancing learning environments beyond the confines of the classroom by including buildings nearby such as artisan workshops and museums, as well as gardens and courtyards, can undeniably contribute to the improvement of school climate and learning quality.

A distributed and networked school is anticipated in the future, wherein investments are dispersed among various tangible and intangible structures encircling the primary buildings. These buildings will remain the primary repositories of a constellation of educational spaces and experiences (Ibidem).

It is essential to note, however, that the implementation of Outdoor Education, which is founded on the principles of experiential learning and place-based education, requires a clearly defined interdisciplinary planning process. Outdoor active learning experiences must complement their indoor counterparts in order to engage students to their fullest. By providing guidance and support, educational intentionality safeguards against these pathways becoming mere decontextualized pastimes. Instead, it converts them into significant learning experiences that integrate and stimulate all the students' senses in accordance with a *holistic approach* (Giunti et al., 2021).

Outdoor Education encompasses a wide range of potential educational activities.

That includes a wide range of experiences, including perceptual sensory encounters (e.g., educational vegetable gardens, visits to farms, museums, parks), sociomotor and exploratory activities commonly associated with adventure education (e.g., orienteering, hiking, sailing), and school projects that integrate technological proficiency with an appreciation for the natural world (e.g., coding, robotics, tinkering) (Giunti et al. 2021, p. 8).

When considering these situations, the archetypal classroom as an educational space is substituted with the term "learning environment, which refers to the collection of technical, logistical, and educational resources that define the school setting" (Sidoti, 2018, p.372).

The traditional classroom, divided between the teacher's desk and desks, where those who copy are sanctioned, gives way to collaborative learning environments that promote students' mental and physical well-being, such as *learning islands*.

Adopting a holistic approach to school innovation entails not only considering teaching methodologies and relationships within the educational community, but also the *learning environment*, which, if artificial, must be well-planned, structured, constructed, and experienced. By doing so, we retrace every step in the chain of events associated with a design logic, beginning with the formative intent of those who establish the environment (Castoldi, 2017, p.324).

Additionally, the implementation of digital technologies in the classroom has necessitated the adoption of constructivist pedagogical approaches—that is, methods predicated on the notion that knowledge is co-constructed rather than transmitted. These methodologies not only redefine the teacher's role to that of a *facilitator* of learning processes, but also require open and flexible learning environments where students can feel "free from constraints of time and space" (Castoldi, 2017, p.373) and easily connect with their peers. Neuroscience asserts that experiential methodologies, which rely on the processing of bodily sensations and emotions, are the most effective. To achieve this, learning environments must be adaptable and flexible enough to accommodate the needs of their inhabitants. While conversing while seated in a circle in the school garden or at a desk in the classroom, one's manner of expressing one's own thoughts and willingness to consider those of others by paying attention to them are altered.

This reinforces the idea that pedagogy is "not an adjuvant" (Weyland, 2021, p.218) in the design of learning environments, but must collaborate on an equal footing with architecture and neuroscience to find the best solutions for those who will inhabit them with their bodies, minds, and emotions.

3. Embodied cognition and learning environments

The Italian school is focused on instances of the mind and less inclined to attend to the health of the body, as evidenced by both standardised and poorly ergonomic school furniture to which students must adapt and school times that rarely include moving breaks to release accumulated tension and relax (Rimoli Giambonini, 2013).

Even colour schemes that promote visual ergonomics have the potential to enhance the learning experience.

[...] In addition to being a decorative element, colour has specific effects on health and mood. Colours and their language have always represented a communicative-expressive code of emotions, feelings, and symbolic meanings. The incorporation of colour into educational (and other) settings promotes the overall psychological and physical health of individuals and enhances their motivation. It improves students' and/or teachers' sociability and enthusiasm in their work and studies, as well as their operational competence and ability to concentrate (Gagliardi et al., 2016, p.66).

The majority of Italian pupils devote the majority of their time to seated at a desk. The neglected emphasis on physical activity and the body in Italian schools may be traced back to a fundamental fallacy of Western culture, which Cartesian dualism, according to Antonio Damasio, is the source of.

What was ... Descartes' error? ... the I think, therefore I am. [...] This statement contradicts my own beliefs regarding the relationship between the mind and body and the origins of the mind; it implies that thinking and the awareness of thinking are the fundamental components of being. And, because Descartes envisioned thinking as a separate activity from the body, it celebrates the separation of the mind, the "thinking substance" (*res cogitans*), from the non-thinking body, endowed with extension and mechanical parts (*res extensa*) Damasio (1995, pp.336-337).

The Portuguese neuroscientist refutes the notion that cognition is accomplished by abstract, pure, and disembodied processes by illustrating the significance of emotions and feelings in decision-making through a series of clinical cases. Embodied cognition, a scientific approach to educational neuroscience (Gomez Paloma et al., 2016), posits that the brain and body are subject to reciprocal conditioning.

The presence of a brain is a *sine qua non* for a body to generate a mind, but a brain can only express a mind if it is embedded in a viable body. [...] (Peru, 2011, p.42).

The environment is an essential reality

for the brain, not only in an indirect sense, as it supplies the body with vital elements such as food, air, and water to ensure its survival, but also and particularly in a direct sense, as it provides sensory stimuli, which are vital for brain activity (*Ibidem*).

Current cognition theories posit that the majority of cognitive processes are underpinned by the interplay between the human body and the environment (Bersalou, 2008; Wilson, 2002).

The influence of emotions on learning (Rivoltella, 2012) and the correlation

between physical activity and improved learning and memory (Sousa, 2010) are two areas of neuroscience research that offer novel opportunities to enhance learning and instruction.

Physical activity and movement in general promote healthy mental and physical development and predispose the brain to learning and attention, according to neurological research. On the other hand, sitting for more than 15 minutes inhibits learning because

the brain 'believes' it is in a resting state, since no 'navigating' behaviour in the environment has been detected for an extended period of time. The student develops lethargy and drowsiness, and has difficulty maintaining focus. The capacity for learning is significantly impaired at this juncture (Olivieri, 2016, p.90).

Certain research studies in the field of neuroscience (Reilly et al., 2012) propose that subjects that involve movement, such as mathematics, can be simplified to learn by capitalising on the correlation between physical activity and enhanced learning induced by the stimuli it provides to the prefrontal cortex. This is because engaging in physical activity improves students' concentration, which in turn leads to improved performance. Thus, one of the challenges of the new millennium is revealed by the potential of neuroscience in improving teaching practises and guiding the design of school environments to "incorporate physical exercise into learning activities" (Olivieri, 2016, p.102).

Conclusions

The school must transform itself from a *hostile* space to which to adapt, neutral, bare, and standardised in its furnishings into a place to *inhabit* that defines itself through the relationships it creates with its host territory and the emotions it arouses in those who experience it. The transition from solitary classroom work to collaborative learning environments, including those located across the globe, and from the role of an *infallible arbiter of knowledge and harsh assessor of academic performance* to that of a *facilitator* of learning and well-being, has the potential to transform the school into an innovative and inclusive setting where students are engaged as active participants and protagonists of their own education. Designing the educational space in the manner taught by Montessori, Dewey, Pizzigoni, and Malaguzzi strengthens its pedagogical identity, promoting that cultural change that, by protecting the psycho-physical health of its inhabitants and enhancing their talents, strengthens the link between education, democracy, and the quality of life that all students should be guaranteed.

Redesigning and redeveloping learning environments cannot be delegated solely to professionals in the fields of engineering and architecture. Rather, they must strive for innovation and personalization of learning paths in relation to time and

space, drawing inspiration from the pedagogical gaze and the findings of neuroscience. The active participation of the educational community in the planning or renovation of schools, based on the actual needs and experiences of the people who use them and guided by specific pedagogical criteria and educational goals, results in the creation of spaces with a distinct identity that are closely connected to the territory.

By integrating knowledge and discoveries from the field of neuroscience into learning environments, specifically by emphasizing the physical and emotional aspects of teaching, it is possible to increase student engagement and thereby improve student performance. When guided by educational design and intentionality, simulations, experiments, outdoor education experiences, and increased emphasis on physical education and movement in the school curriculum have the potential to improve learning-teaching processes and positively impact learner motivation. An ongoing conversation between neuroscience, pedagogy, and architecture that rethinks the school and its environments from different points of view makes it possible to create conditions that support learning and physical and mental health. This strengthens the sense of community membership, which helps keep schools from becoming unsettling places to learn and prevents educational instability that leads to antisocial behaviour or dropping out early.

Each adolescent's school experience influences the evolution of his or her personal history in one direction or another (Palmonari & Graziani, 2004, p.15).

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