

Architecture, Nature and Education: Space as the Third Educator

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Abstract:

This essay explores the relationship between school architecture and pedagogy through the experience at the Green School in Bali, where the natural environment is central to the educational process. Drawing on direct observation and research, it examines how building design influences students' autonomy, creativity, emotional regulation, and relationship with nature. The analysis highlights benefits such as stress reduction, promotion of physical activity and encouragement of pro-environmental behaviors, as well as challenges including acoustic isolation, environmental maintenance and safety. By connecting theory, pedagogical practice and architecture, the essay offers a critical reflection on how educational space supports students' holistic development, suggesting new directions for innovative pedagogies and sustainable learning environments.

Keywords:

Educational Space, Green School of Bali, School Architecture, Sustainability

Arquitetura, Natureza e Educação: O espaço como o terceiro educador

Resumo: Este ensaio reflexivo explora a relação entre arquitetura escolar e pedagogia a partir da experiência na Green School de Bali, onde o espaço natural é parte central do processo educativo. Com base em observações diretas e literatura científica, reflete-se como o design dos edifícios influencia autonomia, criatividade, regulação emocional e contacto com a natureza. A análise evidencia benefícios, como redução do stress, promoção da atividade física e estímulo a comportamentos pró-ambientais, bem como desafios, incluindo isolamento acústico, manutenção ambiental e segurança. Ao articular teoria, prática pedagógica e arquitetura, o ensaio oferece uma reflexão crítica sobre o papel do espaço educativo na formação integral dos alunos, sugerindo novas perspectivas para pedagogias inovadoras e ambientes de aprendizagem sustentáveis.

Palavras-chave: Arquitetura Escolar, Espaço Educacional, Green School de Bali, Sustentabilidade

Architecture, Nature et Éducation: L'espace comme le troisième éducateur

Résumé: Cet essai réflexif examine la relation entre l'architecture scolaire et la pédagogie à partir de l'expérience de la Green School de Bali, où l'espace naturel constitue un acteur central du processus éducatif. S'appuyant sur des observations directes et sur la littérature scientifique, il analyse comment la conception architecturale influence l'autonomie, la créativité, la régulation émotionnelle et le rapport à la nature. Les résultats mettent en évidence des bénéfices tels que la réduction du stress, la stimulation de l'activité physique et la promotion de comportements pro-environnementaux, mais aussi des défis liés à l'isolation acoustique, à la maintenance écologique et à la sécurité des usagers. En articulant théorie, pratique pédagogique et conception de l'espace, cet essai propose une réflexion critique sur le rôle du milieu bâti dans la formation intégrale des élèves. Il suggère enfin que la synergie entre architecture, nature et éducation peut constituer un levier essentiel pour le développement de pédagogies innovantes et de cadres d'apprentissage durables. Aqui deve estar o resumo do artigo em francês.

Mots-clés: Architecture scolaire, Développement Durable, Espace Éducatif, Green School de Bali

Arquitectura, Naturaleza y Educación: El espacio como el tercer educador

Resumen: Este ensayo reflexivo analiza la relación entre la arquitectura escolar y la pedagogía a partir de la experiencia en la Green School de Bali, donde el espacio natural es un componente central del proceso educativo. Basado en observaciones directas y en la literatura científica, examina cómo el diseño de los edificios influye en la autonomía, la creatividad, la regulación emocional y el contacto con la naturaleza. El análisis evidencia beneficios como la reducción del estrés, la promoción de la actividad física y el fomento de conductas proambientales, así como desafíos relacionados con el aislamiento acústico, el mantenimiento ambiental y la seguridad. Al articular teoría, práctica pedagógica y arquitectura, este ensayo ofrece una reflexión crítica sobre el papel del espacio educativo en la formación integral de los estudiantes, sugiriendo nuevas perspectivas para pedagogías innovadoras y entornos de aprendizaje sostenibles.

Palabras clave: Arquitectura escolar, Desarrollo Sostenible Espacio Educativo, Green School de Bali

Introduction: Educational Space

We first learned about the Green School in Bali from a television program on architecture. We figured that anyone who builds such a unique school must hold a very distinctive view of education—and we were not mistaken. The opportunity to take part in the “Green Educators Experience” program at this school in May 2025 prompted us to rethink teaching comprehensively. Above all, the experience underscored how space shapes learning – an area that stands among the leading trends in educational research (Barrett et al., 2019).

Today’s debate about school infrastructure has moved beyond basic health and safety requirements like granting hygienically safe spaces, ensuring air circulation and natural light, as well as providing adequate room and furniture for the number of students in the classroom – elements that remain essential. Nowadays, the aim is to “build and upgrade education facilities that are child, disability, and gender sensitive, and provide safe, non-violent, inclusive, and effective learning environments for all” (UN cited in Barrett et al., 2019), as outlined in the United Nations Sustainable Development Goals. Conversely, a global shift toward student-centered pedagogies requires rethinking educational spaces that are still often organized for traditional lecture-driven, content-centered teaching methods.

1. The Green School of Bali

Visitors to the Green School of Bali quickly perceive that those who conceived and designed the buildings understood, like Loris Malaguzzi, founder of the Reggio Emilia approach, that space is as an educator in its own right – the third educator (with student-teacher and student-student relationships being the first and the second educators, respectively). Set in the middle of the Balinese jungle near the village of Abiansemal, the school campus spans about 8 hectares and includes more than 70 bamboo buildings. At the center of the campus, the first structure built, the iconic “Heart of School,” which now hosts classrooms for grades 6, 7, and 8. Rising about 14 – 15 meters and 60 meters in length, a ground floor, and two upper floors, this building impresses all visitors, combining traditional Balinese bamboo construction with contemporary design and modern electrical and technological infrastructures. The school's other buildings share these characteristics. Some incorporate unique – for example, the gymnasium “The Arc” has an arched roof built with an anticlastic gridshell system and its floor uses recycled

airplane tires. Sustainability was clearly a guiding priority in the campus design of these buildings.

In addition, construction techniques and materials were intentionally educational: to foster environmental respect through the built space, since “the environment interacts, transforms, and is transformed through the actions and experiences of children and adults” (Lino, 2018, p.101).

The couple who designed the Green School, John and Cynthia Hardy, aimed from the outset to ensure that, if the school ever closed, nature could reclaim the site within a few years, “swallowing” the buildings. Originally, the school was intended to be off-grid, doing without the supply of electricity. However, in 2021, this decision was reversed: it was concluded that educating a 21st-century citizen required implementing familiarity with new technologies. Notably, 30 – 40% of the electricity used at the Green School comes from solar panels, and a system is currently being developed to harness water power to generate electricity.

The buildings' aesthetic quality is remarkable: they sit gracefully within the landscape, creating spaces that not only inspire awe but also induce a sense of serenity. Veà Vecchi, one of the first atelier teachers in Reggio Emilia kindergartens, stated that “the aesthetic dimension presupposes a gaze that discovers, admires, and is moved. It is the opposite of indifference, negligence, and conformity” (Hoyuelos, 2006, pp. 15-16). These premises provide precisely the enriching experience that Vecchi highlights: no one remains indifferent to their beauty, combining noticeable mastery of building techniques and creative details that continually arouse surprise and delight in users.

The buildings have no doors or windows, allowing the flexible bamboo structures to withstand heavy rains and strong winds, especially during the wet season. The roof coverings made mostly of straw – efficiently protect students from rainfall, although they demand frequent upkeep with evident financial and environmental costs. A student's team, supported by some teachers, is currently studying more sustainable roofing solutions on campus projects.

Even a visitor unfamiliar with the school's pedagogy can see that the campus is designed for children to grow in direct contact with nature. Nature is literally in the classroom, where students coexist with all kinds of animals – such as insects, amphibians, reptiles, birds, and mammals (including the school's dogs and cats). A variety of natural elements, such as stones, plants, fruits, and mushrooms, are equally present in the classrooms. Interior and exterior spaces are differentiated mainly by the presence or

absence of a roof. Again, the conscious or unconscious influence of the Reggio Emilia vision is obvious: classes take place in spaces which are “neither completely indoors nor really outdoors” (Dominguez, 2024, p. 394), fostering learner autonomy, exploration, discovery, and inquiry. The playground is essentially the surrounding jungle, with few modifications: only a mud puddle for younger children, some mud and bamboo stairs to facilitate movement; the removal of affected coconuts is a safety measure to prevent injuries from falling fruit.

Most water closets use ecological sanitation: dry composing toilets without a flush, where waste is covered with dry sawdust to aid natural decomposition and later applied as fertilizer in school gardens. Campus water comes from three sources: well, harvested and treated rainwater, and a system that collects and filters humidity from the air, transforming it into potable water.

These facilities naturally thrill environmentalists, architects or teachers who value their role as educators, ecologically conscious individuals seeking to teach life in harmony with nature. However, while the campus offers many educational opportunities, it also presents challenges that call for careful consideration.

Benefits and drawbacks of the Green School of Bali's space

As noted, at the Green School, there is no physical separation between natural environment and classroom; rather, both spaces interpenetrate, offering multiple advantages.

The first concerns student well-being. A 2017 study by Dettweiler et al. showed that outdoor lessons contribute to reducing students' stress. The study measured the levels of cortisol (a stress hormone) in two groups of children, three times daily, via saliva sampling. (In a healthy individual, cortisol spikes upon waking, decreases by midday, and stabilizes in the afternoon, dropping again from 4–5 p.m. to bedtime). During the study, the control group had indoor classes every day, while the other group had one forest-based class per week. The outdoor group displayed a healthy cortisol pattern, whereas the control group's cortisol levels failed to drop in the afternoon, indicating sustained stress. Direct contact with nature, therefore, appears to benefit stress regulation. Exposure to stressful situations during childhood is linked to stress-related illnesses later in life (Torsheim et al., 2003). Consequently, “measures to reduce stress and to build up stress resilience in schools need to be found” (Dettweiler et al., 2017, p. 2).

A growing body of research shows that contact with nature benefits children's mental well-being (Arola et al., 2023). For instance, Wells and Evans (2003) found that children living in rural areas, surrounded by nature, reported fewer behavioral stress-related problems and anxiety levels, and higher self-esteem, compared to children in a less natural environment. Emerging evidence also suggests that nature-based practices can strengthen young children's self-regulation – the ability to control emotions, inhibit impulses, and delay gratification (Ernst & Stelley, 2024).

Direct engagement with natural ecosystems also benefits physical health. Pereira et al. (2024, p.5), after reviewing 51 articles on outdoor play for children aged 5–12, concluded that “of the eligible studies, 30 chose PA [physical activity] as the primary outcome (25 exclusively and six in combination with other outcomes)”. Green spaces are associated with higher physical activity and the development of skills such as dexterity, balance, and strength. Sharifi et al. (2024, p.16) likewise found that greater access to greenspace is associated with lower SBP/DBP (systolic and diastolic blood pressure) or lower risk of HTN (hypertension), as well as a lower chance of being overweight or obese with a lower BMI (body mass index) and lower BG (blood glucose) levels and lipid profiles.

Literature also reports positive effects on attention maintenance and cognitive development. Mason et al. (2022) reviewed 14 studies examining the impact on students ranging from primary school to university of short-term exposure to nature – meaning, brief interruptions (from 10 to 90 minutes) of classroom learning. The review shows that in 12 out of the 14 studies, across educational levels, cognitive benefits emerge in terms of directed attention restoration from mental fatigue due to contact with nature. A no-cost opportunity to sustain students' cognition is a break in a green environment after mentally demanding activities (Mason et al., 2022, p.609).

From an educational standpoint, Brazilian evidence points the same way: a study with 224 young adults reinforces the point: space itself, immersed in the forest, educates for sustainability. Rosa et al. (2018, p.8)

found that positive childhood contact with nature improves adults' self-reported pro-environmental behaviors (PEBs) both directly and indirectly via current experiences in nature. Direct, daily contact with nature appears to foster appreciation and protection of the environment – people only protect what they know and value.

At the Green School, there are no locked spaces. There are neither doors or windows, nor lockers or locked cabinets, an architectural and educational statement of trust in students' judgment and responsibility. Even in the “Innovation Hub (IHub),” a workshop with potentially hazardous tools (saws, drills, sanders, welding tools, etc.), the space is fully open and materials are accessible but tool use by students is limited to supervised, scheduled sessions.

While the student-nature symbiosis promoted by Green School's architecture offers clear benefits, it also poses challenges. The absence of doors and windows results in poor sound insulation, easily provoking diversion. In the main building, six classes of 20 to 25 students each are separated by simple bamboo partitions. Even in buildings used by just one or two groups of students, classes are negatively affected by unwanted noise from adjacent spaces.

Rance et al. (2023) compared the academic progress of children aged 7 to 10 in open-plan classrooms, shared by multiple groups of students, versus enclosed classrooms, where classes are separated by walls and doors. Reading fluency increased faster (reading speed measured in words per minute) in the enclosed condition, particularly for students with poorer speech-in-noise perception and/or weaker attention skills. Using a portable acoustic divider, while keeping all other variables constant, “was associated with clear differences in academic progress with 64% of students showing a higher rate of reading fluency development in the enclosed-classroom condition” (Rance et al., 2023, p. 5).

Although open-plan designs can foster a dynamic and interactive learning environment, they may pose challenges for certain types of learners. Students with attention deficit hyperactivity disorder are more prone to distraction, while more introvert personality types inclined to quiet reflection may struggle in a noisier atmosphere.

In addition, animals wandering into learning areas can also disrupt attention and raise hygiene and health issues: for example, bird droppings on top of cabinets were observed.

Climatic and biological factors also pose challenges: at Green School Bali, tropical conditions, including monsoons, are partially mitigated by bioclimatic measures such as extended eaves and vegetated roofs (Shim, 2010 apud Azevedo & Ribeiro, 2015). Even so, protection against heat and humidity remains limited. The absence of walls further complicates the control over thermal comfort when ambient temperature runs high. The Holistic Evidence and Design [HEAD] study (Barrett et al., 2015) emphasizes that classroom temperature is a key to ensure comfort and concentration, enhancing students' academic performance.

In open-plan settings, high humidity is equally difficult to control, accelerating the deterioration not only of paper-based schoolwork but also of books and notebooks. At the school entrance, a preschool class has posted a list of pros and cons for the school; among the negatives, they singled out books damage from excessive humidity.

Nevertheless, architectural solutions such as open-wall perimeters and central skylights allow passive cross-ventilation, natural air circulation, and diffused daylight, reducing artificial lighting needs (Shim, 2010 apud Azevedo & Ribeiro, 2015).

Although the space of the school communicates a strong sense of ease, this atmosphere also seems to have unintended effects. In the main building classrooms, the lack of an easily understandable storage system for school materials leads to visible clutter and disorder. Such disorganization not only undermines efficiency but also contradicts the school's ecological ethos, as misplaced or damaged supplies translate into avoidable waste of resources.

Close contact with nature inevitably entails risks that demand constant attention. Forest schools, for example, are guided by a pedagogical vision – reflected in both their architecture and spatial organization – that grants children full freedom to play and explore without being constrained by fear of injury. Naturally, strategies exist to mitigate risks such as the risk of falling. As described by an Italian teacher during training, children in her school were required to always maintain three points of contact when climbing trees.

Beyond the risks common to all forest schools, the Green School in Bali faces additional challenges due to its complete immersion in the Balinese rainforest and its minimal environmental modification. The difficulties include the presence of venomous insects and wildlife such as snakes and monkeys (two teachers reported an unfriendly encounter with a monkey during training), alongside frequent heavy rainfall with the associated risk of flooding and landslides, and strong winds capable of toppling trees or branches. The reliance on natural building materials such as bamboo also requires vigilant inspection and upkeep.

To address these issues, the school has implemented measures such as educating students about forest hazards and equipping them with the knowledge to respond to specific situations, carrying out regular structural maintenance, and establishing evacuation procedures. These practices seek to balance the pedagogical value of immersive, nature-based learning with the safety expectations of a secure education environment.

Statement on the Use of Generative Artificial Intelligence (GenAI)

I declare that GenAI tools, such as Chatgpt, were used for translation. The authors are solely responsible for the content of their manuscripts.

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