



The governance configurations of green schoolyards

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ABSTRACT

In light of the growing interest in naturalizing schoolgrounds this paper explores the governance configurations that enable, produce and sustain their multiple benefits. We scrutinize the existing literature analysing the norms, actors, and processes through which green school grounds are conceptualized, designed, implemented, and sustained. We find that good schoolyard governance is exhibited by: i) the actual use that children make of the naturalized areas, and by its repercussion on their physical and mental well-being, social integration, sense of place, and socio-environmental awareness; ii) the ways outdoor environments intersect with school curriculums; iii) by the availability of public support and funding lines with flexible, anticipatory and adaptive features; and crucially iv) by the ways that architects and gardeners engage with the concepts of ecology, creative play and outdoor education in the acts of schoolyard (re)making. We also find that at times focus on program effectiveness (efficiency, goals) infringes upon justice and inclusion. The way participative processes are interpreted, and eventually inform schoolyard designs and uses is one of the challenges to consider in this respect. Greening schoolyards also requires participation processes that are accessible and inclusive for adults and children from a variety of socio-cultural, ethnic and economic contexts. In a nutshell, naturalizing schoolyards needs to go beyond the search for narrow technical solutions for climate adaptation or pedagogical innovation, being a process of school (re)making. The governance framework suggested here is apt for analysing a range of urban green interventions

1. Introduction

The development of green, climate adaptive and diverse schoolyards is steadily populating municipal and school agendas across Europe and North America (Baró et al., 2022; Stevenson et al., 2020). The reasons are manifold. The European Climate and Health Observatory (European Climate and Health Observatory, 2022) found that 43% of the schools in European cities report temperatures that are at least 2 °C higher than the regional averages, while 10% are located in potential flood-prone areas. Indeed, the removal of paved schoolyard surfaces combined with the amplification of varied vegetation has the potential to influence the climate of the surrounding areas, reducing the urban heat island effect, enhancing resilience to flooding (Flax et al., 2020) and contributing to climate adaptation altogether (Antoniadis et al., 2018). Green, or nature-rich, areas in schools may furthermore enhance biodiversity by serving as stepping stones to species flow (Lojá et al., 2014). Another fundamental reason for the popularity of greening schoolgrounds has to

do with the slashed opportunities for unstructured outdoor play, and for spending time in nature surroundings, which children have been exposed to over the past decades (Kemple et al., 2016).

Green schoolyards¹ tend to feature various forms and typologies of nature. They are often perceived as experiential spaces that open room for creativity in play and learning through the presence of elements made of living plants and weathering timber (Van Nispen et al., 2014). The 'green' in the schoolyard is not limited to flowers, grass lawns or edible plants, but features the 'brown', sand, mud, dead branches, tunnels, as central components creating a both climate-adaptive and fascinating environment that affords more varied, interactive and innovative play than paved surroundings (van Dijk-Wesselius et al., 2022; Kuh et al., 2013).

Naturalized schoolgrounds are known to have a wide range of benefits for schoolchildren and young adults (van den Bogerd et al., 2023). The frequent use of these spaces has been associated with diversified play and physical activity (Raney et al., 2019; Kemple et al., 2016;

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¹ The term 'green schoolyards' is used interchangeably here with naturalized, climate-adaptive, natural, nature-rich and nature-based schoolgrounds to broadly refer to spaces with permeable surfaces, varied vegetation and elements made of natural materials that diversify play and provide opportunities for outdoor learning.

Mårtensson et al., 2014) leading to enhanced: i) physical and mental health (van Dijk-Wesselius et al., 2018; van Dijk-Wesselius et al., 2022; Marchant et al., 2019; Chawla et al., 2014); ii) emotional well-being (Bikomeye et al., 2021; McCormick 2017); iii) social (cohesion) (Bohnert et al., 2021; Raney et al., 2019; Lucas and Dymont, 2010); iv) cognitive development and academic achievement (Maes et al., 2021; Kuo et al., 2021; van Dijk-Wesselius et al., 2018); along with nature connectedness and socio-ecological consciousness (Jickling and Sterling, 2017; Dymont, 2005). The widespread deployment of green schoolyards could also offer more equitable and gender-neutral play opportunities in a way that encourages creativity and socialization (van Dijk-Wesselius et al., 2022; Lucas, 2010; Paechter and Clark, 2007). Equitable access to nature in the school could further help reduce existing health disparities (Bikomeye et al., 2021).

School playgrounds, however, mirror the particular social, cultural, economic and political configurations of local geographies. Green schoolyards are being developed in a context of blatant urban green gaps (Van Velzen and Helbich 2023, (Anguelovski et al., 2022; Łaskiewicz and Sikorska, 2020), and therefore reflect the stark inequalities in the availability and accessibility of natural/ized areas between multi-ethnic, working-class neighbourhoods and urban territories inhabited by middle-class and well-off residents (Baró et al., 2021; Bohnert et al., 2021; Bates et al., 2018). The visible features of schoolyards, (such as the fact that tree cover in disadvantaged schools is roughly half, or less, of those serving white, well-off students (Kuo et al., 2018) also reflect the less-visible participation and decision-making processes associated with schoolgrounds' development (Raney et al., 2023; Zhang et al., 2022; Bates et al., 2018).

The way green schoolyards are initiated and negotiated, by whom and with what implications are questions that have remained relatively underexplored in the literature. While the heterogeneity of stakeholders normally involved (e.g., students, school staff, parents, public administration, architects, gardeners, civil society organizations) may suggest great inclusivity and environmentally sound outcomes, the distribution of power and influence (Arts et al., 2006) between the actors involved may thwart the widespread benefits of green schoolyards. This requires paying particular attention not only to the effectiveness of reaching set goals, but to questions of justice, equity and reflexivity in the process of (re)designing schoolyards (Bennett and Satterfield, 2018).

In light of the growing relevance and pursuit of naturalized and climate-adaptive spaces in school environments, in this paper we aim to pursue the governance configurations that enable, produce, expand and sustain the manifold benefits of green schoolyards. This said, governance is a complex and contested term, notion and practice (De Angelis, 2022; Peet et al., 2019; Lemos and Agrawal, 2006) composed of diverse elements and attributes that do not come neatly together, calling for an interpretation from a range of theoretical perspectives. In this article we build on the environmental governance framework developed by Bennett and Satterfield (Bennett and Satterfield, 2018) and the Policy Arrangements scheme by Arts et al. (Arts et al., 2006), complementing these with perspectives on governance stemming from urban political ecology and (urban) environmental justice. We scrutinize the existing literature on schoolyard greening analysing the norms, actors and processes through which school playgrounds are conceptualized, designed, implemented, sustained and used, supplementing insights from the literature with in-depth interviews by key informants from pioneering green schoolyards interventions in Europe.

2. Theorizing the governance of green schoolyards

In their review paper Bennett and Satterfield (Bennett and Satterfield, 2018), provide a broad and encompassing definition of environmental governance as placed at the junction of: *i*) laws, policies, rules and norms (also referred to as institutions), *ii*) structures (decision-making bodies, formal and informal organizations), and *iii*) processes, (decision-making, conflict-resolution, and value negotiation).

Environmental governance can be further placed at the juxtaposition of actors, resources, power, rules and discourses (Arts et al., 2006).

In this paper we adapt the work by Bennett and Satterfield (Bennett and Satterfield, 2018) to the reality of green schoolyards, and supplement it by Arts et al. framework, adding a transversal category that concerns the distribution of power across all sub-sections. We have thus opted to define and operationalize governance here as the: *i*) norms (laws, regulations, rules, policies, discourses); *ii*) actors (institutional bodies and (in)formal networks); and *iii*) processes (communication, decision-making, negotiation and conflict resolution) that jointly determine the production of climate adaptive schoolyards (Table 1). In essence, our conceptual framework suggests examining who takes decisions, for whom, in what ways, to what effect, to whose benefit/cost, with what underlying narratives and underpinned by what distribution of power. In other words, naturalized schoolgrounds can be conceptualized as urban green commons, whose creation, reinforcement, reproduction, and use entails the interaction and continuous negotiation between multiple stakeholders, narratives, norms, and power constellations.

Our major additions to the framework of Bennett and Satterfield (2018), inspired by (Arts et al., 2006), hence concern: 1) stressing the role of actors' discourses, or the narratives employed by them on a range of issues that surround schoolyard greening; and 2) the distribution of power as a transversal category across all sections. Arts et al. discuss power in the sense of the mobilisation, division and deployment of resources and the actors' influence in determining policy outcomes. Power (distribution) as an analytical concept in Fig. 1 therefore implies not only the actors' capacity to direct and distribute resources and capital, but to influence the discourses that frame each particular governance context along with the way problems are being defined and addressed (Foucault, 1998).

Bennet and Satterfield (2018) further suggest the following four general desirable qualities of environmental governance: effectiveness, equity, responsiveness and robustness. We take inspiration from, draw on, and adapt their categorization, adjusting it to the context of schoolyards, and elaborate the following categories of desirable governance attributes: effective, just, responsive and vigorous (Table 1). *Effective* governance here encompasses: a clarity of goals; an orientation toward participative processes; coordination across roles, functions and mandates; reliance upon diverse knowledge types and pedagogic trainings; decision-makers' accountability; and the application of efficiency criteria. The governance of green schoolyards is considered *just* here when concerns around the distributional, procedural, recognition and restorative aspects of justice are sought, addressed and integrated. *Responsive* governance then implies: an orientation towards continuous learning; anticipation of risks and deficiencies; adaptiveness to changing local socio-ecological and economic realities; flexibility in management; and openness to experimentation. Finally, the *vigorous* attribute of green schoolyard governance concerns the extent to which arrangements, processes and actors can be considered legitimate, connected, nested and polycentric. Table 1 provides a detailed definition of each sub-attribute, along with the most relevant academic sources that we draw on for their identification.

3. Methodology

The main source of data for this paper is academic and grey literature on green schoolyards, comprising texts published in indexed journals, supplemented by a few reports by public institutions and relevant non-profit organizations. As of December 2023, the word search through "GREEN" + "SCHOOLYARDS" word entries provided 65 results (Scopus) and 421 hits in ScienceDirect. Upon filtering through the titles, 60 of these fitted the scope of our research. Through the process of reading the selected articles and their bibliographies we eventually included 58 other sources (arriving at 108 academic articles in total).

In scrutinizing the literature, we simultaneously looked for insights

Table 1
Desirable attributes of green schoolyard governance.

Governance attribute	Description	Relevant references
Effective		
Goal clarity	Comprehensive goals of the green schoolyards, along with benchmarks of success, have been established and agreed upon (among all stakeholders).	(Van Nispen tot Pannderden et al., 2014; Maas et al., 2014)
Participation-oriented	Spaces and processes that enable the participation and engagement of a range of (schoolyard) stakeholders have been established, where power relations are considered and acted upon.	Flax et al. (Flax et al., 2020), Giezen and Pellerey, (Giezen and Pellerey, 2021), (van Dijk-Wesselius et al., 2021), Muela et al. (Muela et al., 2019), Kreutz et al. (Kreutz et al., 2018), Jansson et al. (Jansson et al., 2018), Derr and Rigolon, (Derr and Rigolon, 2017), Maas et al. (Maas et al., 2014), (Van Nispen tot Pannderden et al., 2014), Rigolon, (Rigolon, 2011), Chawla and Heft 2002, Hart, (Hart, 1997)
Coordinated	The roles, functions and mandates around the (green) schoolyards visioning, development and maintenance are coordinated across agencies and stakeholders.	Giezen and Pellerey, (Giezen and Pellerey, 2021), Jickling et al. (Jickling et al., 2018), Rigolon et al. (Rigolon et al., 2015), Maas et al. (Maas et al., 2014), Dymment and Reid, (Dymment and Reid, 2005), Jickling et al. (Jickling et al., 2018), Dymment, (Dymment, 2005)
Qualified	Sufficient capacity, skills, and knowledge around green schoolyard development and use for educational purposes are available and actively applied.	van Dijk-Wesselius et al. (van Dijk-Wesselius et al., 2020), Zhang et al. 2021, Marchant et al. (Marchant et al., 2019), Jickling et al. (Jickling et al., 2018), Jickling and Sterling, (Jickling and Sterling, 2017), Van Nispen et al. 2014, Passy 2014, Dymment and Reid, (Dymment and Reid, 2005)
Informed	Decisions around green schoolyards development, and their use for educational purposes, are informed by the best available information (e.g., on the benefits of green schoolyard), and on a diversity of knowledge types.	(van den Bogerd and Maas, 2024; Raney et al., 2023; Raney et al., 2019; Hoover and Sarvenaz, 2021; Maas et al., 2021; Bikomeye et al., 2021; Kuo et al., 2021, 2019; Van Dijk-Wesselius et al. 2022, 2018, van den Bogert et al. 2020; Luís et al. 2020; Lindemann-Matthies and Köhler 2019; McCormick 2017; Laaksoharju, and Rappe 2017; Wells et al. 2015; Chawla et al., 2014; Gill 2014; Iojá et al., 2014; Van Nispen et al. 2014; Kuh et al., 2013; Lucas and Dymment 2010; Dymment, 2005; Malone and Tranter 2003; Nicholson, 1972)
Accountable	Decision-makers are accountable, and the rationales for their decisions (e.g., the criteria for school inclusion in funding, or design selection) are made clear and transparent.	(Giezen and Pellerey, 2021; Rigolon et al., 2015; Maas et al., 2014)
Efficient	The most desirable outcome (along the criteria agreed upon through multi-stakeholder involvement) is achieved with least environmentally damaging materials and energy, while	(Stevenson et al., 2020; Mostert, 2021; Maas et al., 2014; Van Nispen et al. 2014)

Table 1 (continued)

Governance attribute	Description	Relevant references
	using a cost-efficient strategy.	
Just		
Fair	The (material) benefits and costs/burdens, associated with the green schoolyard development and use are distributed equitably across all urban landscapes and geographies (<i>distributive justice</i>).	(Van Velzen and Helbich 2023; Raney et al., 2023; Zhang et al., 2022; Giezen and Pellerey, 2021; Bikomeye et al., 2021; Bohnert et al., 2021; Baro et al. 2021; Stevenson et al., 2020; Kuo et al., 2018; Bates et al. 2016; Garwood et al., 2016; Dymment and Bell, 2008)
Inclusive	The participation and decision-making processes around green schoolyard visioning, development, maintenance and use are inclusive of a variety of stakeholders, whereas power relations are monitored and attended to (<i>procedural justice</i>).	(Stevenson et al., 2020; Derr, 2017; Derr and Rigolon, 2017; Jansson et al., 2018; Rigolon et al., 2015; Kreutz et al., 2018)
Recognition-based	Diverse perspectives, values, needs, and rights are being acknowledged in the visioning, development, maintenance and use of schoolyards (<i>recognition justice</i>).	(van Dijk-Wesselius et al., 2018; Rigolon et al., 2015; Derr, 2017; Mårtensson et al., 2014; Rigolon, 2011)
Restorative	Past damages (e.g., in green deprived, low-income, multi-ethnic neighborhoods) and gender-blindness are being recognized and compensated for (<i>restorative justice</i>).	(Bohnert et al., 2021; Mårtensson et al., 2014; Lucas and Dymment 2010; Paechter and Clarke 2007)
Responsive Learning	Monitoring, evaluation of, and reflection upon the performance and use of green schoolyards is regularly undertaken, and all produced information is documented, shared, and fed into decision-making.	(Giezen and Pellerey, 2021; Van Nispen et al. 2014; Maas et al., 2014; Rigolon, 2011)
Anticipatory	The potential risks, deficiencies, or conflicts associated with green schoolyards' development, maintenance and use are being discussed early on.	(Mostert, 2020; Mostert, 2021; Kreutz et al., 2018; Maas et al., 2014)
Adaptive	Spaces for deliberation on the existing institutional arrangements and management plans around green schoolyards are created in the visioning, design, maintenance and use stages, and these are revisited and adapted so as to reflect on-going socio-ecological changes.	(Mostert, 2021; Kreutz et al., 2018)
Innovative	Experimentation in the schoolyard is encouraged, and its outcomes - well monitored.	(Marchant et al. 2017; Laaksoharju and Rappe 2017; Maas et al., 2014; Rigolon, 2011)
Flexible	Managerial and rigid approaches toward green schoolyards' design, development and maintenance are avoided so as to fit local needs and realities.	(Muela et al., 2019; Van Nispen et al. 2014; Rigolon, 2011)
Vigorous Legitimate	The institutions/coalitions involved in the visioning,	(Giezen and Pellerey, 2021; Flax et al., 2020; Kreutz et al., 2018;

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Table 1 (continued)

Governance attribute	Description	Relevant references
Connected	design, maintenance and use of green schoolyards are perceived as legitimate and supported by their constituency.	Buckley et al. 2017; Maas et al., 2014)
	The organizations and actors involved in the development, maintenance and use of the schoolyards are well-linked (vertically and horizontally), allowing for the establishment of vibrant support networks.	(Giezen and Pellerey, 2021; Stevenson et al., 2020; Buckley et al. 2017)
Nested	Decision-making authority around green schoolyards' development and use is assigned at the lowest possible level, facilitating the empowerment and self-organization of the school community, while supported by, and embedded into higher policy levers.	(Giezen and Pellerey, 2021; Hensen, 2021; Mostert, 2021; Stevenson et al., 2020; Hoover and Sarvenaz, 2021; Derr and Rigolon, 2017; Dymment and Reid, 2005; Dymment, 2005)
Polycentric	Decision-making around the design, development, funding, maintenance and use of green schoolyards is not centralized, but located across several jurisdictions and scales.	(Flax et al., 2020; Derr and Rigolon, 2017; Van Nispen et al. 2014; Maas et al., 2014; Dymment and Reid, 2005; Dymment, 2005)

on the three governance categories (norms, actors and processes), and their attributes (Table 1), while searching for new and emergent themes, following the readjusted framework presented in Fig. 1. Understanding the key norms that underpin, influence and frame the development and use of green schoolyards in the literature, for example, required looking at structural conditions and features, such as policies and regulations, funding and implementation requirements, along with the narratives employed around these. Understanding the participation and involvement of different actors then implied looking at the roles and (discursive) influence of stakeholders like school staff, children, parents, designers/architects, and public institutions/funders, among others. Studying the processes that surround and frame (green) schoolyard's production and use finally entailed exploring the communication, participation, decision-making, negotiation and conflict-resolution strategies and

practices employed along the way.

Henceforth, the eventual set of questions that underpinned our analysis was: What are the key norms and processes that influence, frame and facilitate green schoolyards, as revealed in the literature? What are the actors, institutional bodies and informal networks that engage with, and influence their development, establishment, and eventual spread-out? What are the stumbling blocks that enable, and the factors that preclude, the effective, just, responsive and vigorous governance of schoolyards?

As a way of grounding, and partially validating, our literature review findings, we cross-checked insights with members of public administrations and practitioners from Belgium (Brussels Environment), France (Municipality of Paris), Spain (Municipality of Barcelona), the Netherlands (Municipality of Rotterdam), and UK (Learning Through Landscapes) having an expert knowledge on green schoolyards' deployment (n=5). We conducted semi-structured interviews on the relevance of our tripartite scheme of governance (norms, actors, processes), along the key attributes that we identified (effective, just, responsive and vigorous), while scrutinizing issues of power. The interviews were analysed holistically, so as to corroborate and fine-tune insights from the literature analysis, especially along the axes of existing local policy and funding configurations. In particular, we inquired on the exact policy schemes that facilitated the development of green schoolyards in each country/city, their rationale, and the particularities of the associated multi-stakeholder participation processes, along with the (institutional, procedural, or pedagogic) tensions and stalemates generated and/or surpassed throughout the design, implementation and establishment of new schoolgrounds. Interviews were particularly useful for adding detail on areas that we identified as grey, or incomplete in the literature, such as institutional adaptation and design flexibility. Overall, interviews aligned well with the general trends identified in academic writing and policy reports, while adding more detail on the norms and actors that constitute the green transformation of schoolgrounds.

As per our methodological limitations, given the qualitative nature of this study, largely grounded in the academic and grey literature, we do not attempt to exhaustively or quantitatively gauge the extent to which the governance of green schoolyards can be considered effective, just, responsive and vigorous. Rather, we discuss the relevance of these attributes, as well as the barriers to their proper unfolding, inasmuch as they appear, or as conferred, in the literature. Another major methodological limitation of the paper is its Northern positionality and scope spanning from the authors' West European situatedness (allowing for the review of policy papers and reports written in Catalan, Dutch and Spanish), along with the peer-reviewed articles written in English-

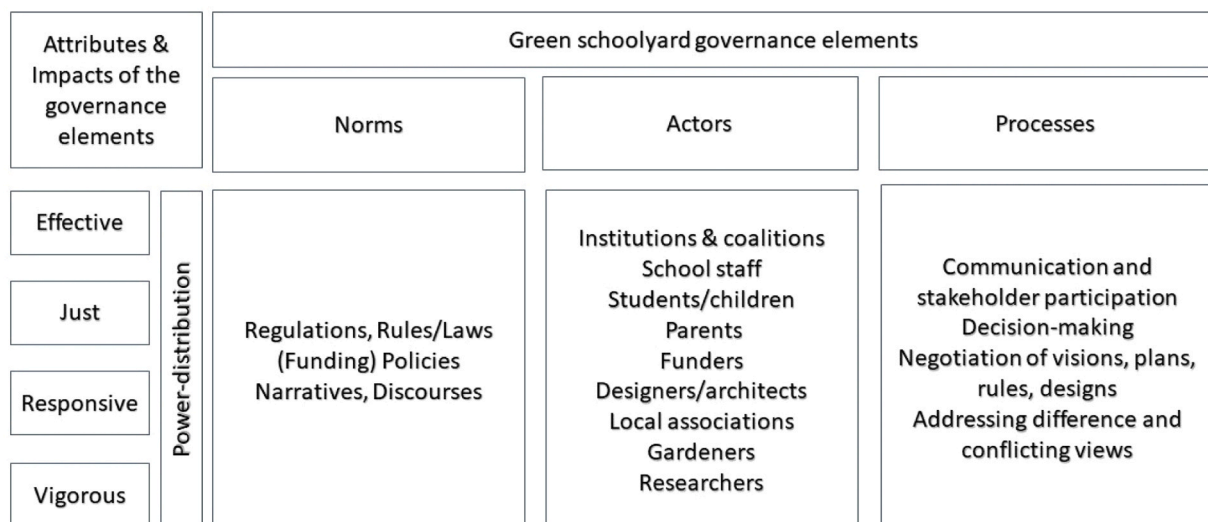


Fig. 1. Governance elements and attributes (own elaboration based on Bennet and Satterfield (2018)).



Fig. 2. The governance of green schoolyards.

language. Our analysis and overall conclusions are biased and strongly influenced by the projects and evaluations conducted and publicized in parts of Western Europe, North America and Australia. While there are clear signs and evidence that green schoolyards have been historically present, and now re-emerge,² in Eastern Europe and the Global South, we found few English language sources in the academic literature to engage with.

4. Results

The key trends identified through our engagement with the literature, as well as from the interview analysis, are presented below, organized along the three key elements of governance (norms, actors, processes). While all sub-attributes (of effective, just, responsive and vigorous governance, Table 1) are relevant for all three governance elements, in the text below, and for reasons of brevity, we highlight only those that are most relevant for the stated categories (norms, actors and processes). In order to enhance the readability of our findings, we furthermore distilled and summarized the core results from the literature that pertain to each governance attribute (across norms, actors and processes) in Table 2.

² One notable example is the Green Week National Program in Romania, promoting education for sustainability and in contact with nature across multiple schools in the country.

4.1. Norms

In Europe, municipal initiatives for climate-adaptive educational environments are steadily growing (Baró et al., 2022). Some notable examples, among many others, are the “Transformem els patis/Refugis Climàtics” programs in Barcelona, “Oasis” in Paris, “Opération Ré-création” in Brussels, “Groenblauwe Schoolpleinen” in Rotterdam or Amsterdamse Impuls schoolpleinen, in Amsterdam. In parallel, a number of non-for-profit initiatives like *Learning Through Landscapes* in the UK, *Movium* in Sweden, *Springzaad* in the Netherlands, and *Eco-Schools* in numerous countries, have been undertaking important work that has placed nature-based schoolground and learning on the forefront of schools’ and policy-makers’ agendas.

If one was to pinpoint the common discourse, or narrative, employed by the institutions that promote and provide green schoolyards, it would be around their multiple benefits. Most of the reviewed policy documents acknowledge that green schoolyards can simultaneously contribute to urban climate resilience and adaptation (Flax et al., 2020), children and young adults’ physical activity, interaction and diversity in play (Ajuntament de Barcelona, 2021; Mostert, 2021), to their health and emotional well-being, cognitive development and learning achievement (Bikomeye et al., 2021; Kuo et al., 2021). Discourses on the role of nature-rich schoolgrounds as places to learn beyond play and rest, and outdoor education in general, are also increasingly present in policy reports (Ajuntament de Barcelona, 2021; van Dijk-Wesselius et al., 2020; Marchant et al., 2019; Van Nispen et al., 2014; Chawla

Table 2
Key findings along all governance attributes.

Governance attribute	Key findings
Effective	
Goal clarity	Clarity on the purpose of green schoolyards (e.g., as experiential nature-based squares that open rooms for creativity and diversity in play, or for outdoor pedagogies) amongst key stakeholders is a core condition for effective design and implementation (Van Nispen et al. 2014; Maas et al., 2014).
Participation-oriented	Participation-oriented governance implies paying due attention to: i) the way participation processes are designed, orchestrated and enacted (e.g. aiming at iterative or, transformative participation (Ito et al., 2014) across all stages of schoolyard greening, (e.g., in some schoolyard greening processes architects have been involving children beyond the preparatory stages, inviting them to work along with professionals as an educational practice (Maas et al., 2014); and ii) the way its results are summarized, interpreted and taken into consideration at the level of decision-making and implementation (Kreutz et al., 2018).
Coordinated	Regulations and policies that underpin schoolyards' naturalization need to be better coordinated and connected with existing climate adaptation and resilience planning programmes, along with national educational plans and strategies (e.g., prescriptive curricula, persistent testing pressure, and institutional focus on efficiency/speed preclude the effective utilization of educational environments) (Marchant et al., 2019; Dyment and Reid, 2005). Educational policies need to adopt a comprehensive view of learning by integrating outdoor education as way to stimulate reflection and engagement (Jickling et al., 2018; Dyment, 2005).
Qualified	Nature-rich school areas translate into students' awareness only when instructors actively navigate this process. In order to facilitate the learning of children in green schoolgrounds and guide them through open and flexible real-life, or bodily, experiences, teachers need to be familiar with the values and opportunities of outdoor learning through continuous professional development (van Dijk-Wesselijs et al., 2020; Jickling and Sterling, 2017).
Informed	Effective schoolground greening requires architects who fond of natural materials and understand the educational objectives of the reform, and gardeners who strive for a balance between neatness and messiness (or who depart from an understanding of ecology, children's play and pedagogy) (Maas et al., 2014; van Nispen et al. 2014).
Accountable	Effective governance requires transparent and justice-tuned selection criteria for funding decisions (e.g., as in the "Operation Ré-création (Brussels)", "Refugis Climatic (Barcelona)", "Oasis (Paris)" and "Groenblauwe Schoolpleinen" (Rotterdam) programs.
Efficient	In some cases (e.g., Barcelona, Paris) final decision-making on implementation is relegated to the architects and the public (funding) agencies, drawing on solutions and expertise available at the level of the publicly employed technical offices, while in others (e.g., Rotterdam) municipal funders approve the choice (of architects, and on design) made by the school. The former approach is efficient at replicating given interventions in a wide number of schools, and the latter - at providing a sense of ownership, leadership and actors' agency.
Just	
Fair	Public school systems have the capacity to (partly) mitigate some of the inequalities in the distribution of green infrastructure at neighbourhood level (Zhang et al., 2022; Bohnert et al., 2021). Yet educational institutions located in economically disadvantaged green-deprived districts hardly have the human and material resources and expertise to advance, and engage in, schoolyard greening, and therefore need additional (public) support (Kuo et al., 2018). Establishing a universal minimum standard, or level, of greening in schoolyards could be one approach to enhance distributive justice in this sense (Zhang and Stevenson, 2021).
Inclusive	The failure to view children as competent participants throughout all phases of schoolyard greening is a common conundrum (Rigolon et al., 2015). The tokenistic involvement of school-children and young adults obstructs their full

Table 2 (continued)

Governance attribute	Key findings
	appreciation of (and care for) new vegetation and nature-based installations in the schoolyard (Jansson et al., 2018). The remodelling of the Burke Park and adjacent schoolyard in Boulder (USA) is one example how the effective children participation/involvement only in the initial phases, combined with rushed time frames and a change in the distribution of decision-making power at advanced stages of development, lead to disappointing results from the perspective of the young adults (Kreutz et al., 2018).
Recognition-based	Schools with migrant and economically vulnerable populations have considerably more difficulties finding parents with the time to dedicate to the design and maintenance of school grounds, especially considering the large student turn-over due to families facing house evictions, or work-related migration. In the case of the multicultural Harrison Park school in Portland (US), an association developed and maintained a school garden in association with an existing community garden used by many Chinese, Burmese, and Latino immigrant and refugee families (Garwood et al., 2016).
Restorative	In paved schoolyards, girls tend to be (and have historically been) systematically excluded from the space and play opportunities by boys who dominate the grounds with competitive ball-based games (Pawlowski et al., 2016). Greening schoolyards and diversifying the infrastructure in schoolyards in Sweden (and elsewhere) has had restorative effect on children, allowing girls to be less passive, more actively engaged in play behaviour and more empowered to "take space" (Mårtensson et al., 2014; van Dijk-Wesselijs et al., 2018, 2022).
Responsive Learning	The responsive governance of green schoolyards requires continuous evaluation of, and therefore learning from, all implementation rounds (and associated regulations) that have enabled and sustained green schoolyards (Giezen and Pellerey, 2021; Van Nispen et al. 2014).
Anticipatory	Taking the time to pause at different points of the transformation process to negotiate stakeholder expectations, attend to power imbalances and learn from past missteps is essential (Kreutz et al., 2018; Mostert, 2020).
Adaptive	Upon evaluating the first project rounds of the "Groenblauwe Schoolpleinen" program (Rotterdam) and "Refugis Climatic" project (Barcelona), officials observed that the maintenance efforts required for the natural compounds had been underestimated, which led them to reconsider and adapt earlier protocols (Mostert, 2020; Mostert, 2021).
Innovative	The approach used in the "Groenblauwe Schoolpleinen" program (Rotterdam), where municipal agencies let schools take the lead on the intervention, while advising then on sourcing technical support allows for innovative designs tuned to the needs of the school. Furthermore, the production/ implementation stages of green schoolyards provide excellent and innovative learning opportunities (Maas et al., 2014)
Flexible	As children's personal identities are shaped through the unobstructed exploration of undefined space, green outdoor learning environments should leave 'part of the canvas incomplete' with unfinished, or flexible, spaces and elements that young adults continuously interact with and interpret, as a process of place-making (Rigolon, 2011). Flexibility is furthermore needed for fruitful collaborations with parents and local community (which emerge when schools place less predetermined, or fixed petitions (Van Dijk-Wesselijs et al. 2021)
Vigorous Legitimite	Stakeholders' support for, and legitimization of, the actors that carry out the transformation project contributes to its endurance and sustainability (Giezen and Pellerey, 2021; Maas et al., 2014).
Connected	Successful experiences tend to spill-over across geographies when schools are interconnected (Buckley et al. 2017)
Nested	Embedding schoolground greening in public policy (and funding priorities) has proved fundamental for sustaining these initiatives over time and space (Giezen and Pellerey, 2021; Stevenson et al., 2020)
Polycentric	Neither central management, nor complete decentralization of green schoolyards' governance is desirable (Mostert, 2021; Van Nispen et al. 2014)

et al., 2014). Next, the (potential) role of nature-based schoolyards in addressing green space accessibility and availability in the city is a thematic thread mostly discussed in the academic literature with relatively scant mention in policy documents (Van Velzen and Helbich 2023; Raney et al., 2023; Zhang et al., 2022; Baró et al., 2021; Bates et al., 2016). Finally, the discussion on the contribution of green schoolyards to neighbourhood cohesion and addressing the challenges of health-related pandemics (Quinn and Russo, 2022; Flax et al., 2020; Stevenson et al., 2020) also present in the literature, though relatively scarcely.

Moving onto the terrain of regulations, green schoolgrounds are initiated and enabled through a great diversity of funding agencies and programs. In the US, for example, public support for nature-rich schoolyards has been low historically (Stevenson et al., 2020), with some notable exceptions (such as Chicago, Austin, Denver, and San Francisco), where municipal agencies or voter-approved bonds have funded schoolyard greening. This trend is however slowly changing, especially as a number of federal states, such as California, have started installing funding lines that facilitate schoolyard greening.³

Overall, evidence shows that embedding schoolground greening in public policy has been fundamental for sustaining these initiatives over time and space (Hensen, 2021; Hoover and Sarvenaz, 2021; Mostert, 2021). Green schoolyard initiatives that mostly rest on private donor support, or on the voluntary contributions of school community members, either suffer from poorly maintenance and (semi)abandonment once initial enthusiasm dwindles (Baró et al., 2022; Dymont, 2005), or get discontinued once donors' funding priorities change. Contrasting publicly and privately funded schoolyard programs undertaken in two large Dutch municipalities⁴ (Giezen and Pellerey, 2021) find that funding programs and their conditionalities can have a strong leverage on the outlook and use of green schoolyards. While applying for funding through the private donor could be less bureaucratic for school administrations, political support there could change overnight and induce the program's discontinuity (*ibid*). Municipal funding programs might entail higher administrative burden and conditionality, but tend to ensure longer-term stability, along with the provision of additional expertise and resources. The availability of a steadfast institutional support or funding lines was also noted as an essential condition for sustaining naturalization efforts in schoolgrounds by all interviewees.

Going forward, governance accountability, and hence effectiveness, imply sharing and justifying the rationale for funding decisions. In the case of "Rotterdam Blue Green Schoolyards",⁵ for example, inclusion is weighed upon quantitative features like green space availability, climate resilience and socio-economic vulnerability at the level of the neighbourhood (50%), and qualitative factors like the motivation, vision, and operational capacity of the school community (50%). The selection criteria for the "Operation Ré-creation" (Brussels), "Refugis Climatics" (Barcelona), and "Oasis" (Paris) programs also rest upon a mix of socio-economic parameters, school motivation, and the availability of impermeable space and vegetated surfaces in the area.

Regulations and policies that underpin schoolyards' naturalization furthermore need to be better coordinated and connected with existing climate adaptation and resilience planning. Schoolyards are frequently inserted in complex and diverse policy levers that may overlap and sometimes obstruct the extensive or innovative deployment of green elements in school compounds (Stevenson et al., 2020). The complexity

of rules and regulations is markedly visible at the level of green schoolyards' implementation and use, which is subject to series of protocols, regulations, and guidelines per construction, sanitation and security in many countries. Overall, the extent to which these are implemented as part of broader climate adaptation, urban resilience and biodiversity strategies, or plans, remains to be seen. Establishing a minimum standard, or level, of greening in schoolyards could be one way to enhance policy integration (Zhang and Stevenson, 2021).

Likewise, the cross-pollination between schoolyard greening programs and national educational plans is very much in a nascent phase. This is one of the reasons behind the general underutilization of schoolyards for outdoor learning beyond the early years despite widespread recognition of its contribution to children's social, physical, and emotional well-being and cognitive development in the literature and policy reports (Van Dijk Wesselius et al., 2020, 2018; Bikomeye et al., 2021; Kuo et al., 2021; Luis et al., 2020; Raney et al., 2023; Marchant et al., 2019; Chawla et al., 2014; Maas et al., 2014; Kuh et al., 2013; Bell and Dymont, 2008; Dymont and Bell, 2008). On the one hand national laws and regulations do not grant much financial leeway to schools to organize their educational programs and environments in a child-centred way (Mostert, 2020). On the other hand, even when public agencies explicitly condition their funding on the utilization of naturalized schoolyards for educational purposes,⁶ once the subsidy has been expended, they have little lever to influence the integration of outdoor education in the pedagogical vision of the school (Giezen and Pellerey, 2021), interviews).

The limited use of green schoolgrounds for teaching is frequently explained with prescriptive curricula, persistent testing pressure, high number of headline targets and institutional focus on efficiency, speed and effectiveness (Marchant et al., 2019; Maas et al., 2014; Van Nispen et al., 2014), leaving little room for deviation from classroom settings (van Dijk-Wesselius et al., 2020; Stevenson et al., 2020). The thrust for green schoolyards may thus lay bare an incongruity between the (narrow) measurements that children and young adults are judged upon and the wider aims of education (Dymont, 2005). The narratives and findings around the wider benefits of outdoor learning tend to clash with its general undervaluation by education inspectorates, and narrow curriculum requirements (Marchant et al., 2019). Many authors thus advocate for informed, coordinated and connected public policies that adopt a comprehensive view of learning, integrating outdoor education not as another token, or "technical tool" for learning, but as a way to stimulate reflection and engagement (Jickling et al., 2018; Dymont, 2005).

Furthermore, the responsive governance of green schoolyards requires continuous evaluation of, and learning from all implementation rounds and the policies and regulations that frame, enable and sustain green schoolyards. Adaptability therefore emerges as a crucial policy attribute both in the literature and in conversations with practitioners in the field. Upon evaluating the first project rounds of the "Blue Green Schoolyards" program (Rotterdam) and Refugis Climatics (Barcelona), for example, officials observed that the maintenance efforts required for the naturalized compounds had been underestimated, which led them to adapt protocols or dedicate it a bigger fraction of the budget. This said, public regulations and policies that pertain to the terrain of school systems are slow to develop, vote-upon, and enact, making their adaptability to the changing contexts and local needs rather strenuous.

Finally, the norms that underpin schoolyards' greening have clear justice implications. Some Dutch programs (Giezen and Pellerey, 2021; Van Nispen et al., 2014) for example, had a €10.000 of co-funding requirement which created an impediment for educational institutions located in underprivileged neighbourhoods. While school communities situated in middle-class neighbourhood can easily access funds and

³ <https://www.greenschoolyards.org/grant-opportunities>

⁴ One of these is the "Amsterdam Impuls Schoolpleinen" (AIS), an ongoing municipality-funded initiative aiming to (re)design school playgrounds in the city, providing up to €70.000 per school. The comparison initiative is the "Groene Schoolpleinen" (GS) program launched by the Fonds 1818 private foundation in The Hague and neighbouring towns, granting up to €25.000 per schoolyard naturalization.

⁵ <https://zoek.officielebekendmakingen.nl/gmb-2022-74523.pdf>

⁶ Amsterdam Municipality, https://www.amsterdam.nl/sociaaldomein/onderwijs-leerplicht/duurzame-schoolgebouwen/amsterdams-e-impuls-schoolpleinen/#PagCls_15145617; last accessed February 9th 2023

volunteers with the skills and the time to contribute to project application and schoolyard maintenance, educational institutions located in economically disadvantaged districts do not have the required resources, expertise, and overall support. As a result, most of the applications under programs with co-funding requirement tend to originate from middle-class neighbourhoods (Giezen and Pellerey, 2021). Hence at times focusing on implementation efficiency can infringe upon justice, even if admittedly funding is available to all schools. This said, public school systems have the capacity to mitigate some of the inequalities in the distribution of green infrastructure at neighbourhood level (Zhang et al., 2022). Findings by (Bates et al., 2018), and (Bohnert et al., 2021), furthermore show that green interventions on schools in underserved, and underprivileged areas could strengthen not only distributional aspects of environmental justice, but contribute to higher levels of physical activity, social cohesion, sense of safety, or restorative forms of justice altogether.

In this thread, opening up schoolyards to the neighbourhood has been/is one of the explicit schoolyard greening requisites in Amsterdam (Giezen and Pellerey 2022), Rotterdam (Mostert, 2021), Paris (City of Paris, 2022) and Barcelona funding policies (Ajuntament de Barcelona, 2022). While the literature and empirical reports around that are scant, the intention behind this policy is that nature-rich schoolyards enhance community ties and social cohesion by means of enlarging the pool of people who may sustain, and care for, the space and improving nature accessibility (Giezen and Pellerey 2022; Flax et al., 2020; Stevenson et al., 2020).

4.2. Actors

The stakeholders that promote and co-develop nature-based transformations on school grounds are ample and diverse. School communities (teachers, staff, students, parents), public authorities, funders, landscape architects and engineers normally play a central role, often with the support of local associations and researchers. This said, the coalitions that get established, along with the representation, ranks, power and influence of different actors vary. Among the variety of stakeholders that co-produce green schoolyards, for example, children tend to have relatively little decision-making power. Their petitions are often deemed unrealistic, and eventually discounted (Rigolon et al., 2015; Kreutz et al., 2018; Zhang and Stevenson, 2021). Yet, adults are not necessarily the experts on the type of elements children will eventually play, or engage with (Flax et al., 2020; Maas et al., 2014). Being the alleged ‘target’, or main beneficiary, of schoolyard greening, children stated views and visions may need thorough consideration beyond the preliminary and scoping phases (Giezen and Pellerey, 2022; Muela et al., 2019; Rigolon et al., 2015).

Notably, in paved schoolyards girls have historically been systematically excluded from the space and dominant play (Pawłowski et al., 2016), as open areas tend to favour competitive ball-based games (Paechter and Clark, 2007). A study at two Swedish schools from 2014 found that while in open areas girls were often standing passively around soccer fields, in green schoolyards they were more actively engaged in play (Mårtensson et al., 2014). These observations are later echoed in studies by Van Dijk-Wesselius et al. (2018, 2022) and others who find a larger impact of schoolyard greening on play diversification for girls (aged 7–11) than boys. Surveying a number of Australian schools (Lucas and Dymont, 2010), on the other hand, argue that green, or naturalized, areas tend to be gender-neutral. Overall, greening and diversifying schoolyards empowers girls not only to actively engage in play behaviour, but to take and occupy space from which they have been previously excluded.

Next, school staff and teachers are frequently the ones who initiate the schoolyard remaking process and actively navigate all of its phases. Nonetheless, nature-rich school areas translate into student awareness only when instructors actively facilitate this process (Zhang and Stevenson, 2021; Hoover and Sarvenaz, 2021). Surveying tutors in six

primary schools with green compounds in the Netherlands, van Dijk-Wesselius and colleagues (2020) find that the absence of outdoor expertise in formal teacher training and the associated low self-confidence in conducting classes outside, form some of the core barriers to the extensive use of natural areas for educational purposes. Teachers are often trapped in a conflict between the extra work associated with organizing outdoor classes and its lack of acknowledgement within school institutions (Marchant et al., 2019). The increasing pressure and overload faced by educators thus needs to be factored in, so that outdoor educational practice reinvigorates their professional development and inspiration to re-discover educational approaches, rather than constituting a burden. Teachers thus need to become facilitators of learning that stems from open, flexible, real-life, and bodily experiences connected to children’s abilities, needs, and interests (van Dijk-Wesselius et al., 2020). The effective and vigorous schoolyard governance requires qualified, informed and connected/networking teachers whose familiarity with the values and opportunities of outdoor learning are enhanced through continuous professional development around non-instrumental approaches to learning (Marchant et al., 2019; Jickling et al., 2018; Jickling and Sterling, 2017; Dymont and Reid, 2005).

As per parents and families, in function of geographies and cultural coding, one strand of the literature reports relatively high parent engagement in schoolyard greening and maintenance (Ajuntament de Barcelona, 2022; Hensen, 2021). Others perceive families as hard to reach, or difficult to engage with the proposals launched by the school (van Nispen et al., 2014). In the study of (van Dijk-Wesselius et al., 2021), while parents show a lot of appreciation for greening schoolyards, over half of them report unwillingness to help with maintenance tasks. The authors however find that parents’ interest in getting engaged through a representative committee and by means of organizing activities is relatively high, implying that fruitful collaborations may emerge when school-staff place less predetermined, or fixed petitions. The responsive governance of naturalized schoolyards thus requires certain flexibility and innovation in approaching and engaging parents.

Architects, engineers and gardeners also have a fundamental influence on green schoolyards design and eventual use. Surveying a range of actors involved in the transformation of 25 schoolyards in the Netherlands, (Maas et al., 2014) argue that successful greening requires architects who are fond of natural materials and understand the educational objectives of the reform. According to the Theory of Loose Parts, for example, elements like branches, bushes, twigs, sand, mud and leaves are fundamental for creativity (Nicholson, 1972), providing children with the chance to design, re-design and give meaning to an assemblage themselves (van Dijk-Wesselius et al., 2022). Nonetheless, most naturalized schoolyards are not particularly rich in loose parts. Indeed, the aerial views undertaken in landscape architecture may sometimes clash with the ground level focus of children (Kreutz et al., 2018). Likewise, schoolyard maintenance requires striking a balance between neatness/orderliness and messiness. A gardening service that prunes away as standard, removing all weeds and branches, for example, would not align with the educational objectives around diverse play and the need for explorative learning (Maas et al., 2014). Maintenance thus needs to depart from an understanding of ecology, children’s play and sustainability-oriented pedagogy (Van Nispen et al., 2014). Overall, adaptability (of design) and inclusivity (of perspectives), through qualified, coordinated, informed and innovative approaches employed by architects, engineers and gardeners are vital for the effective, responsive and just schoolyard governance.

The actor constellations around the design and implementation of schoolyards furthermore need to allow for distributive fairness, process inclusivity and a recognition of diverse needs and rights, along the lines of ethnicity, race and class, among others intersectional markers. The literature and interviews, nonetheless, point to a homogeneity of profiles (mostly white, middle-class individuals) among the stakeholders involved in schoolyard greening (Zhang et al., 2022; Baró et al., 2021; Kuo et al., 2018). An assessment of 99 school gardens in Portland (US)

reveals that it is mostly well-off schools that can afford paying a gardener (Garwood et al., 2016). Schools with migrant and economically vulnerable populations have considerably more difficulties finding parents with the time to dedicate to the design and maintenance of school grounds, especially considering language barriers and the large student turn-over due to families facing house evictions, or work-driven migration. In some cases, non-for-profit organizations can apply for grants and help maintain schoolyard gardens in economically disadvantaged areas. One example is the multicultural Harrison Park school in Portland (US), where an association developed and maintained a school garden adjacent to an existing community garden, used by many Chinese, Burmese, and Latino immigrant and refugee families (Garwood et al., 2016).

4.3. Processes

The effective and just governance of schoolgrounds requires neither central management, nor complete decentralization (Flax et al., 2020; Stevenson et al., 2020). Overall, we identify two tendencies in the governance processes around transforming schoolyards, none of which is completely (de)centralized. One approach centres management and implementation at the level of the public institutions (Paris, Barcelona) and draws on the solutions, catalogues and expertise available at the level of the municipal technical offices. This strategy has proved highly effective in replicating given nature-based solutions in a wide number and variety of schoolyards, but sometimes failing when it comes to the maintenance of the newly planted vegetation or tuning-in interventions to local needs. The other approach, used in the case of the “Blue Green Schoolyards” (Rotterdam), entails municipal agencies letting schools take the lead on the intervention, while advising them on sourcing technical support and granting an approval on the choice of architects and final design. This latter approach may be more time-intensive for school administrations, but ensures a greater sense of ownership, actors’ agency and innovative designs tailored to local needs.

Given the diversity of stakeholders involved in the greening of schoolyards, the communication, participation, and decision-making processes associated with it necessarily entail negotiation around different and, at times, conflicting, views and ideas. Among the schoolyard greening programs that we have reviewed, the participation of the school community in the design has been a funding-prerequisite (Ajuntament de Barcelona, 2022; Mostert, 2021). Yet, funding agencies do not have a way to ensure that a design that is inclusive of all school communities’ needs and visions is eventually selected (Giezen and Pellerey 2022).

Interviews with state officials and the review of literature generally indicate that most efforts are directed to the visioning and preparative stages of participation, being less common at the point of implementation, management and maintenance (Giezen and Pellerey 2022, Derr and Rigolon 2016). The effective collaboration between children, parents, teachers and designers/architects throughout the different phases of schoolyard production can result in significant improvements in the diverse- and explorative play qualities of the schoolyard and its eventual use (Muela et al., 2019). Students are also more likely to care for a place in whose production they have been deeply and continuously engaged with (Zhang and Stevenson, 2021; Derr and Rigolon 2016; Maas et al., 2014). Nonetheless the failure to view children as competent participants throughout all phases is a common trend in schoolyard transformations (Derr and Rigolon 2016; Jansson et al., 2018; Zhang and Stevenson, 2021). Children are mostly involved in the conceptual, or design phase, assuming technical details that compromise their vision are not of their concern (Kreutz et al., 2018; Hart, 1997). Yet, even if children might not have a voice in technical decisions and implementation plans, they need to develop an understanding of the compromises that are taking place, rather than getting disenchanted with the very meaning and process of participation (Hart, 1997). As also argued by (Jansson et al., 2018) in an empirical longitudinal study on Swedish

schools, children’s participation is valuable both in decision-making around design, as well as in the consecutive space management and use.

One example of student-led participation in schoolyard greening that is particularly well-documented in the literature is around the remodelling of the Burke Park in Boulder (USA) as an element of the nearby school compound (Kreutz et al., 2018; Derr, 2017; Derr and Rigolon 2016; Rigolon et al., 2015). The project engaged children (aged from 8 to 13) with adults and professionals in the field of urban planning in thinking together about the new park and schoolyard. In this process, the preparative co-creation involving community meetings, drawing, photography and workshops, has been identified as a particularly successful part of the project (Derr and Rigolon 2016). Catalysed, and supported, by a tight implementation horizon and rigid institutional requirements, the schoolyard greening process eventually got short on time for further reflection, or ‘dreaming’ (Kreutz et al., 2018). Hence, while the initial phase of the participation process is reported as unhurried, fulfilling and creative, once the data from diverse stakeholders had been collected, city architects pursued modelling and implementation without much additional consultations with children.

Hence, the part of effective and just governance that can stagger in transforming schoolyards is the translation of rich and diverse participation material into final designs, strengthening participation levers like delegated power, partnership, or even citizen control (Arnstein, 1969). In the Burke Park case, for example, as students had not been consulted on the latter stages of their schoolyard development, after the end of the summer break they discovered that the renovated space did not resonate with earlier discussions and brainstorming, and rather manifested a limited recognition of the play value of the space that existed beforehand (Kreutz et al., 2018). The children’s disappointment with the nature-play features of the schoolyard is a result of the way their voices had been integrated at the level of decision-making, and their discontinued participation altogether. In other schoolyard greening processes architects have been involving children beyond the preparatory stages, in the building works, inviting them to work along with professionals as an educational practice (in small exercises, such as picking up old tiles) (Maas et al., 2014).

The effective and responsive schoolyard governance therefore needs to entail a continuous monitoring and discussion of major changes with school children, and whenever possible, using the production, or implementation stages of the green schoolyard as a learning and pedagogic opportunity. Rushed construction timelines, discontinued stakeholder involvement, and bringing in new participants in a way that changes decision-making power at advanced stages of the development process are some of the challenges to consider in this respect.

On a further note, children and young adults’ involvement in the naturalization of their school environment strengthens not only their well-being and learning opportunities, but their sense of place (Rigolon, 2011). Students easily get engaged in activities associated with greening schoolyards if invited and encouraged, mostly because of the emotional connection they tend to establish with nature-based settings (Jansson et al., 2018; Chawla et al., 2014). As children’s personal identity is shaped through the unobstructed exploration of ‘undefined’ space, their interaction with, and influence upon, schoolgrounds needs to be continuous and authentic (Chawla, 1992). Involving children as decision-makers in the design and management of their everyday settings can also be interpreted as a process of developing an identity through acts of giving a meaning to a place (Rigolon, 2011). For this reason, the process of greening educational environments should entail leaving a part of the canvas incomplete, with unfinished, or flexible spaces and elements that children and young adults continuously interact with and interpret (Rigolon, 2011).

At times the inclusivity and recognition justice aspect in the governance processes of green schoolyards may clash with efficiency imperatives and considerations. Such quarrels can be anticipated and eventually tailored to the creation of more adaptive and reflexive decision-making processes and policies. Taking the time to pause at

different points of schoolyard greening so as to negotiate stakeholder expectations, attend to considerations of power or missing actors, and learn from past missteps are key considerations to take into account for justice-tuned, responsive and vigorous schoolyard governance (Kreutz et al., 2018). Green schoolyard governance might therefore need a transition from fixed approaches, where every aspect needed for reaching a goal is predetermined, to forms of planning that consider the means of reaching decisions as much as on deemed results (Ito et al., 2014). The latter planning approaches rest on the assumption that green schoolyards are in a constant state of change, and schools commit to an ongoing process of co-creation with nature. In that sense personal and civic development through iterative or transformative participation needs to be considered as an end in itself, in addition to improving the physical characteristics of the space (Kreutz et al., 2018).

5. Discussion and conclusion: the quest for good green schoolyard governance

We argued above that the effective, just, responsive and vigorous, or otherwise, 'good governance' of green schoolyards manifests not only through the quality and quantity of the nature-based, diverse and climate-adaptive elements they integrate, but through the variety of stakeholders, quality of (participative and decision-making) processes, and accessibility, reliability and flexibility of the norms/funding schemes involved. Good schoolyard governance (Fig. 1) is further exhibited by the actual use that children and young adults make of the transformed area, and its repercussion on their physical and mental well-being, social integration, sense of place and cognitive development; and crucially by the ways outdoor environments intersect with school curriculums.

From the perspective of effectiveness, the availability of public funding emerges as one of the baseline conditions for sustaining nature-based schoolgrounds. The governance configurations of the different funding schemes we reviewed oscillate between higher (Barcelona, Paris) versus lower (Rotterdam, partly Brussels) degree of management centralization, in function of the institutional contexts and cultures. Overall, funding schemes and arrangements are most effective when they have flexible, reflexive and anticipatory features, and open up for cross-pollination between climate adaptation, biodiversity preservation, resilience planning and educational strategies and programs.

A key aspect, associated with the effective and responsive governance of schoolyards concerns their design and features. Currently, one may observe a preference for neat and orderly outlooks, with certain avoidance of messiness and loose elements. However, it is precisely such features that powerfully benefit cognitive development, creativity and social skills, allowing children to manipulate and assign schoolyards with a meaning themselves (Van Dijk et al., 2022, 2018). Architects, engineers and gardeners thus need to deeply engage with the concepts of ecology, creative play and outdoor, or experiential, education in the acts of schoolyard (re)making. Responsive governance further entails continuous maintenance, reimagining and remaking of the green schoolyard. Implementing naturalized school grounds initiates a process of adaptation to continuously changing needs and socio-environmental conditions, where unfinished, or flexible, spaces contribute to children and young adults' identity and sense of place (Rigolon, 2011).

Effective and vigorous schoolyard governance furthermore rests upon the extent to which the nature-based interventions are integrated into, or even transform, existing pedagogical strategies and practices. Nature-rich and diverse schoolgrounds do not automatically result in educational, social and cognitive attainments, unless accompanied by adults/teachers (Jansson et al., 2018). The literature is unequivocal that without the active teacher engagement green schoolyards can hardly attain their full potential. Nonetheless, little systemic success has been achieved in terms of the institutional acknowledgment of outdoor education. Environmental education scholars point out that schools need to embrace a Whole School Approach that builds upon a holistic and

systemic perspective (Wals and Mathie, 2022). Effective and vigorous (schoolyard) governance therefore requires that both national educational programs and school objectives are elaborated with an eye on the curriculum-related benefits of outdoor, place-based, experiential and transformative learning, rather than portraying them as an add-on (Marchant et al., 2019; Jickling and Sterling, 2017). To go one step further, as argued by (Jickling et al., 2018), the dominant human-centred vision of education should be overcome to embrace disruptive approaches, (e.g., nature as a co-teacher), that create transformative learning processes through an active engagement with the natural world.

We also find that at times focus on program effectiveness (goals, efficiency) tends to infringe upon governance attributes like justice and equity. Three conclusions can be drawn in this respect. First, just and responsive governance in the context of greening schoolyards implies reflecting upon, and addressing, the uniformity of stakeholders' (socio-economic) differences, meaning that issues of equity and justice are taken into consideration at the level of design, implementation, maintenance and use. Green schoolyards should be perceived and experienced as accessible and inclusive for people from a variety of socio-cultural, ethnic and economic contexts, and importantly - distributed evenly across low- and high-income urban areas (Raney et al., 2023). This said, and bridging with the wider literature on urban environmental justice (Anguelovski et al., 2022) here, while the instalment of climate shelters and richer vegetation in school compounds may favourably influence the development and well-being of students from multiple backgrounds, schoolyard greening cannot mitigate the austere and chronic lack of green space in low-income, ethnically diverse neighbourhoods, on its own, and in general, for the environmental injustice faced by vulnerable, racialized, migrant, and minority populations (Kotsila et al., 2022).

Secondly, the way participation gets orchestrated and organized, or the quality of stakeholders' engagement, is fundamental for the just and responsive governance of schoolyards. Children, for example, are frequently considered non-experts and excluded from consultations on the later stages of development. The tokenistic involvement of children, however, obstructs their full appreciation of, and care for, the new nature-rich space. From a just and responsive governance perspective, the quality of the stakeholder engagement processes, either as an element of planning (Ito et al., 2014), or as a type of iterative and transformative participation (Derr and Rigolon, 2017) needs to be considered as an achievement on its own (Sekulova et al., 2023). In this regard, involving children in the production and implementation stages of green schoolyards as a pedagogical (and participative) exercise is a crucial educational practice.

Thirdly, and relatedly, a fundamental question from a governance perspective is the extent to which the outcomes of the participative processes, including minority views, eventually inform the final schoolyard designs and uses. Rushed time-frames may impede the continuous feedback of children, parents, and teachers and lead to disappointing results (Kreutz et al., 2018). Dedicating sufficient time for green schoolyards' design and development, by making use of prototyping, for example, (Moore and Cooper, 2014), may strengthen their inclusivity and adaptability. Good schoolyard governance should therefore entail pulling synergies together, while understanding, and embracing differences in perspectives, needs, and responsibilities, and addressing dynamics of power and representation (Kiss et al., 2022).

Effective, just, responsive and vigorous schoolyard greening then goes beyond the search for narrow technical solutions for climate adaptation or pedagogical innovation. It is a process of whole school (re) making. While the narrative and imaginary of good schoolyards as nature-based, climate-adaptive, diverse and inclusive is gaining popularity in institutional policy documents and the academic literature, it remains to be seen how this trend in discourses meddles with the generalized pursuit of productivity through narrow educational targets and a strict definition of achievement. As compellingly argued by

(Dyment and Reid, 2005), green schoolyards are an integral element of a wider sustainability transition, and can only be sustained by intertwining and mobilizing social, pedagogical, psychological, and ecological factors. The potential of nature-rich school environments is yet to manifest through the designation of spaces that allow for transformative learning and unlearning (Jickling et al., 2018; Sterling, 2003).

In this regard, and as per research gaps and frontiers, we have noticed little attempts to relate narratives on green schoolyards with research on post- and degrowth transition (Savini, 2021), despite its systemic relevance (Artero and Calcada, 2022). Over the last decades education has been having an instrumental role: to serve the demands of a globalized growth-addicted economy. Quality is ensured by competitions and narrow metrics, while values, ethics, and emotion are relegated a back seat. Yet, the future looks a lot more complex, uncertain and uneven than what a mainstream curriculum might prepare us for (Schmelzer et al., 2022). An educational system that is subjected to the imperative of economic growth and treats students as instruments of productivity, or mere consumers, could well be maladapted for the future. In view of the multiple environmental, social and geopolitical challenges that humanity is facing more research needs to be directed to the type of educational spaces that train us and children to live well within limits, without shifting costs and burdens onto other human and non-human beings, while being conscious of the dare inequalities and disparities locally and globally, along with their colonial legacies and creatively thinking of new community- and solidarity-based responses. Green schoolyards, with the opportunities for outdoor, place-based, experience-based, social and transformational learning seem to be one of the leverage points for social change and sustainability transition out there. Yet, a lot more research could be geared this way.

On a final note, we would underscore the relevance of the governance framework suggested here for gauging other typologies of green and nature-based spaces in the city. Overall, the framework we push forward, where norms, actors, processes are analysed through the lens of power, and along the axes of effective, just, responsive and vigorous governance, is applicable to urban resilience and climate adaptation strategies, new green space development, or various park-remodelling projects, among others. Indeed, scoring high on all attributes listed in Table 1 may not come neatly within a single greening intervention, or nature-based solution. Yet, the framework allows for applying a systemic and multidimensional view of, and approach to, urban (sustainability) planning, one that conceives interventions as embedded into a wider process of city-making. In this sense applying the framework to urban planning could contribute to the formulation of (more) ambitious policy and process-related goals, or rather lay bare the incongruity of existing programs and policy with respect to achieving various types of social/environmental justice and ecological sustainability objectives (Kotsila et al., 2022).

CRedit authorship contribution statement

Isabel Ruiz Mallén: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Validation, Visualization, Writing – review & editing. **Filka Sekulova:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft.

Declaration of Competing Interest

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Data Availability

Data will be made available on request.

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