



European
Commission



School Learning Environments for Sustainability in the EU

Final Report

Education, Youth,
Sport and Culture

EUROPEAN COMMISSION

Directorate-General for Education, Youth, Sport and Culture
Directorate B — Youth, Education and Erasmus+
Unit B.2 — Schools and Multilingualism

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School Learning Environments for Sustainability in the EU

Final Report

edited by PPMI

Manuscript completed in May 2025.

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Print ISBN 978-92-68-26715-8 doi: 10.2766/8830453 NC-01-25-057-EN-C
PDF ISBN 978-92-68-26714-1 doi: 10.2766/0222983 NC-01-25-057-EN-N

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1. Executive summary

1.1. A brief overview of the study

This study aims to explore how education infrastructure and learning environments can be more sustainable and supportive of student health, well-being and learning across the EU. It focuses on institutional and policy-level practices and programmes that help to maximise the positive impact of learning environments. In addition, the study seeks to highlight lessons learned and to showcase good practices in this area to inspire school communities to engage and participate.

While there is increasing awareness of and scientific research on the need to equip students with sustainability competences, develop supportive learning environments and make buildings more energy-efficient, research on the linkages between these topics has so far been limited. Previous studies have identified a need for further research on the knowledge transfer from “green” building features to learning and pro-environmental attitudes and behaviours. In particular, there is a need for research on this topic in the EU, where no similar studies and overviews have been conducted. This study addresses this gap by mapping and evaluating policy and practice on sustainable learning environments in primary and secondary education across the EU, their impact and potential.

The study defines learning environments as the built environment, as well as the natural, digital, psychosocial and pedagogical environment that is accessible inside and outside the classroom *within the campus area*. Learning environments *for sustainability* support “teaching and learning for sustainability by encouraging engagement and connection with others as well as the environment and by inspiring hope and new visions or possibilities for a sustainable future” (Tilbury, 2023, p. 7). Such environments:

- are sustainable, by following environmental and bioclimatic principles (e.g. by integrating green infrastructure solutions that capture carbon and improve air quality);
- follow high-quality learning principles (e.g. paying attention to lighting, noise and accessibility); and
- implement the whole-school approach to learning for sustainability across teaching, operations and management.

The study has adopted a qualitative, mixed methods approach to exploring the intersection of learning and building for sustainability. The initial phase consisted of a review of academic literature, EU policy documents and national strategies to map existing knowledge and regulatory frameworks. Next, eight diverse case studies were selected from different regions, of different scales and types of sustainability projects. These case studies were prepared on the basis of evidence from interviews, site visits and document analysis. The study team created a school toolkit using research, case study insights and stakeholder feedback. They also collected and presented inspiring practices into a compendium of good practices.

1.2. Findings and recommendations

This report finds that environmentally sustainable schools can help to meet climate goals and create opportunities to address sustainability challenges, directly contributing to the objectives of the **European Green Deal** to mitigate greenhouse gas emissions, and the **EU’s Preparedness Union Strategy**, which seeks to enhance societal resilience to future risks, including climate, health and social challenges. As public buildings, schools can set a powerful example by demonstrating how infrastructure can proactively address long-term environmental and societal needs.

Physical learning environments contribute to sustainability by, for example, integrating green infrastructure solutions that **capture carbon, regulate temperatures and improve air quality**. In addition, the renovation of school buildings also demonstrates significant **potential for cost savings** and improved financial efficiency, saving money that schools can channel towards enhancing the quality of learning. In this way, schools that integrate sustainability into their **design, operations and teaching** by creating spaces in which students experience sustainability as an active, lived process, rather than a passive concept.

Well-being and sustainability are interconnected. Schools designed with green spaces and nature-based solutions improve students' physical and mental health, foster everyday resilience, and create a stronger connection to their environment. This aligns with the emphasis of the **Preparedness Union strategy** on mental health, well-being and community resilience as critical components of societal preparedness. **Sustainable happiness**, whereby individual, community and global well-being are considered together, results from a school environment that supports personal and collective responsibility for a sustainable future. The research finds that **contact with nature improves cognitive function, reduces anxiety and enhances attention**. When schools create healthy, inspiring spaces, they not only support student well-being but also encourage a mindset of stewardship and care for the environment.

High-quality learning environments **strengthen both academic outcomes and sustainability competences**. Schools that ensure good air quality, natural light and flexible and connected spaces, taking account of local climate and cultural conditions, create better conditions for learning. Embracing individualisation, stimulation and innovation, and embedding the principles of equity, inclusion and accessibility into the design of the school positively impacts student learning outcomes and strengthens the preparedness of future generations.

However, improving the environment- and health-enhancing properties of a learning environment is not enough. As the present research shows, the strong potential for learning that such spaces hold **often goes under-utilised**, as they often remain static environments that do not engage the learner. School leaders can champion participatory and whole-school approaches that actively invite students, staff and the wider community to co-create spaces that **support both sustainability and learning**. Embedding sustainability into the physical environment, teaching practices and governance helps students to gain the knowledge, critical thinking and sense of agency needed to lead sustainable transformations in their communities and beyond – building the foundations for a more prepared, competitive and fair society.

Policymakers also have a crucial role to play in encouraging and supporting schools in their efforts to transform learning environments. They can accelerate this transformation by **embedding sustainability goals** into national education frameworks, setting enabling regulatory standards, and aligning funding mechanisms to support holistic, inclusive and future-ready learning environments. This includes designing **financing tools** that are accessible to schools, **setting minimum sustainability standards** for infrastructure funding, and incentivising partnerships that connect schools with local communities and climate action. **Targeted support** for teacher training, technical guidance for school design, and inter-ministerial coordination can ensure that schools have the capacity and resources to realise their full potential as catalysts for well-being and the green transition.

2. Introduction

In a world in which seven in 10 young people are “very” or “extremely” worried about climate change (Hickman et al., 2021), **schools play a crucial role as environments**

where lessons on sustainability are not only taught, but can be vividly experienced. Schools, as physical spaces where students spend a significant portion of their lives, should serve as tangible examples of sustainable practices, allowing students to see and live the principles they learn. By integrating sustainable development into the design of the school building, the surroundings and daily activities, schools can inspire students to embrace and champion a more sustainable future.

Many **schools in Europe are at risk from the impacts of climate change** and must introduce climate adaptation and mitigation measures to ensure safe and healthy learning environments. Nearly half of schools across 100 European cities are in areas with strong urban heat effects, at least 2°C warmer than the regional average (European Climate and Health Observatory, 2022). This situation is expected to worsen and negatively impact costs, given that cooling is often more expensive than heating.

School design has the potential to positively **impact students' learning, health, well-being and environment** – often with positive benefits on school reputation and costs. Studies show that learning spaces affect teacher practice (Campbell, 2020), academic performance (Barrett et al., 2019), engagement (Byers, Imms, & Hartnell-Young, 2014), well-being (Cuyvers et al., 2011) and collaboration (Kariippanon et al., 2018).

In addition to supporting learning and well-being, school design plays a vital role in **shaping students' environmental attitudes**, mainly through tangible sustainability features of the built environment, such as minimising resource consumption (Izadpanahi, Elkadi, & Tucker, 2017). When sustainability is embedded not only into the physical design of schools but also into the way they operate, as well as teaching and learning, the benefits extend across student health, educational outcomes, climate resilience and environmental stewardship.

The present study sheds light on how to make education infrastructure and learning environments more **sustainable and supportive of student health, well-being and learning**. While there is increasing awareness and scientific research on the need to equip students with sustainability competences, to develop supportive learning environments and to make buildings more energy-efficient, research on the **linkages between these topics** has so far been limited.

Previous studies have identified a need for further research on the knowledge transfer from “green” building features to learning and pro-environmental attitudes and behaviours. In particular, there is a need for research on this topic in the EU, where **no similar studies** have been conducted. This study aims to address this gap by mapping and evaluating policy and practice in primary and secondary education with regard to sustainable learning environments across the EU, their achievements and potential.

The study is aimed at **all those involved in the infrastructure of primary and secondary schools** in the EU. This includes policymakers, architects, school leadership and management, local or regional authorities, architects, school staff, pupils, parents and the wider community. The report may also be helpful to private sector partners or NGOs involved in school transformation, curriculum development or other supporting roles.

The report begins by providing an overview of the **EU policy context, key terms** and definitions, and **methods used by the study**. Its findings are presented in two chapters. The first summarises **evidence on the impact** of sustainable learning environments on well-being, learning and the environment. This is **illustrated through institutional practices** that enhance the positive effects. The second chapter focuses on an **overview of trends and developments** in policy and practice in the EU Member States. Finally, the report presents overarching **conclusions and recommendations** for key stakeholders.

2.1. EU policy context

Since 2020, the EU has introduced several policy initiatives to promote sustainability in education and infrastructure. The **European Green Deal** and the **European Climate Law** are central to these efforts, aiming for carbon neutrality by 2050 and a legally binding emissions reduction target of 55 % by 2030. These policies influence multiple sectors, including education and construction, by integrating the principles of sustainability. Moreover, the **European Climate Pact** calls on communities and organisations across Europe to act against climate change within the framework of the Green Deal. The topics “green buildings” and “green skills” feature among its initial four focus areas (European Commission, 2020a).

A major initiative under the Green Deal is the **Renovation Wave**, which seeks to improve energy efficiency in public and private buildings. Schools and hospitals are a priority, with the goal of reducing energy consumption, lowering costs and enhancing learning environments (Layke et al., 2016; European Commission, 2019). The European Investment Bank (EIB) and EU funding programmes such as **InvestEU** support these upgrades to modernise climate-resilient infrastructure, aiming “to ensure that the potential of all learning spaces is used effectively and that green schools become an example of best practice to share with school communities” (European Commission, 2022). Likewise, the **EU Preparedness Union Strategy** supports school modernisation, accessibility and disaster preparedness through various funding programmes.

The **Circular Economy Action Plan** promotes resource efficiency and sustainable consumption by encouraging circular economy practices in construction and education. It envisions the launch of a new comprehensive **Strategy for a Sustainable Built Environment** that will promote circularity. The **Green Public Procurement** initiative aligns with this approach, incentivising public authorities to prioritise environmentally responsible purchasing decisions in sectors such as energy, construction and office equipment.

The strategies on sustainability, buildings and materials are supported by other key overarching policy documents and frameworks that crystallise the important role played by schools, training institutions and universities in engaging with students, parents and communities in **learning for sustainability to nurture sustainability competences**. For example, European Council recommendations on **Pathways to school success** underline the need for “healthy learning environments, promoting mental health, healthy lifestyles, and physical and emotional well-being” (Council of the European Union, 2022).

The **European Education Area 2025** and the **Education for Climate Coalition** further support green skills and engagement with sustainability. The **Council Recommendation on Learning for the Green Transition and Sustainable Development** (2022) provides a structured framework for integrating environmental sustainability into education. Complementing this, the **GreenComp** framework defines key sustainability competences such as systems thinking, adaptability and agency, to support lifelong learning that fosters a sustainability-conscious mindset.

The **New European Bauhaus (NEB)** initiative, launched in 2021, integrates sustainability with aesthetics and inclusivity. It promotes environmentally friendly and culturally enriching urban spaces, including sustainable school environments. The **NEB Lab** facilitates collaborative projects that explore sustainable design innovations such as the **transformation of places of learning** project, which connected initiatives, practices and concepts to transform learning places across Europe such as classrooms, streets, playgrounds and libraries. In 2023, the **NEB Prizes** recognised outstanding educational projects that revitalised school spaces and promoted sustainability awareness among students.

To operationalise these policy frameworks, the EU provides a range of funding mechanisms to finance building renovations and enhance energy efficiency, including in school buildings. Notable examples include the **European Structural and Investment Funds (ESIF)** and the **European Fund for Strategic Investments (EFSI)**. **Horizon 2020 Energy Efficiency** contributes through research and by addressing market and government barriers, while the **ELENA** facility offers technical assistance towards energy efficiency in buildings and urban transport. The **Renovation Wave** also includes a financial element (European Commission, 2024).

Other specific funding mechanisms include the **InvestEU Fund** for the period 2021-2027, which mobilises more than EUR 372 billion of public and private investment. Backed by a EUR 26.2 billion EU guarantee, it allocates EUR 9.9 billion to sustainable infrastructure (InvestEU, 2024). The new **LIFE Clean Energy Transition** sub-programme adds nearly EUR 1 billion between 2021 and 2027 to facilitate the transition to an energy-efficient and climate-neutral economy across Europe (European Commission, 2024).

The **Interreg** programme supports cross-border cooperation between local, regional and national governments. Under its **Greener Europe** priority, it channels **EUR 394 billion** into initiatives relating to energy efficiency, climate action, the circular economy, green infrastructure, biodiversity and human well-being (Interreg Europe, 2024).

Lastly, the **Mission on Adaptation to Climate Change** aims to support EU regions, cities and local authorities (of which schools can be a part) in assessing climate risks, addressing pressing challenges and enhancing their resilience against the impacts of climate change (European Commission, 2024). The **Just Transition Fund** is a vital tool under the Cohesion Policy to support climate neutrality and provide tailored support to reduce regional disparities and address structural changes within the EU. Meanwhile, the **Erasmus+ funding programme** promotes education, training and awareness of climate change and environmental responsibility.

2.2. Key concepts

Sustainability and sustainable development

The core of sustainability concerns the long-term goal of human development meeting the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987; Hajian & Jangchi Kashani, 2021). Sustainable development refers to the many processes and pathways to achieving this goal through activities and policies across social, economic and environmental pillars.

Learning for sustainability

Learning for sustainability denotes efforts to support people of all ages in fostering “the knowledge, skills and attitudes needed to live more sustainably, in changing patterns of consumption and production, in embracing healthier lifestyles and in contributing – both individually and collectively – to a more sustainable economy and society” (Council of the European Union, 2022a, p. 2). In addition, learning for sustainability embraces holistic, action-oriented, transformative pedagogy that helps learners to understand the root causes of unsustainability and how to address them. While learning for sustainability is the preferred term in EU documents, other relevant terms, such as education for sustainable development (ESD), may be used in various EU Member States or around the world.

Sustainability competences

Competences are defined at EU level (Council of the European Union, 2018) as a combination of knowledge, skills and attitudes. In the context of this study, competences are seen from a comprehensive perspective that encompasses these different dimensions of learning. Sustainability competences “empower learners to embody sustainability values and embrace complex systems, in order to take or request action that restores and

maintains ecosystem health and enhances justice, generating visions for sustainable futures” (Bianchi, Pisiotis & Cabrera, 2022). GreenComp, the European sustainability competences reference framework, conceptualises four key areas of sustainability competences: (1) embodying sustainability values, (2) embracing complexity in sustainability, (3) envisioning sustainable futures, and (4) acting for sustainability.

Well-being and sustainable happiness

The World Health Organization (WHO) defines well-being as “quality of life and the ability of people and societies to contribute to the world with a sense of meaning and purpose (...) A society’s well-being can be observed by the extent to which they are resilient, build capacity for action, and are prepared to transcend challenges” (WHO, 2021). Well-being is linked to health, since the definition of health covers physical, mental, social and emotional health (Aavik & Dobewall, 2017). According to the WHO, “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 2022). Furthermore, well-being and community-level goals can be seen in the context of broader community objectives, rather than just considering well-being at an individual level. This is often termed “sustainable happiness” or “global/planetary health/well-being”. Sustainable happiness is “happiness that contributes to individual, community, or global well-being without exploiting other people, the environment or future generations” (O’Brien, 2010).

Whole-school approach to sustainability

The whole-school approach to sustainability “seeks to embed learning for environmental sustainability across the institution. It adopts a systemic view of education creating opportunities for living and learning sustainability across the education environment.” (Tilbury & Galvin 2022, p. 8). In other words, all relevant stakeholders should act together to make the critical aspects of the education system (curriculum, professional development, infrastructure, etc.) support sustainability, while regularly reflecting on and assessing their efforts (Mathie & Wals, 2022). The term “whole-school approach” is a crucial one, as it outlines the fundamental principles on the basis of which learning environments should be redesigned and developed to achieve sustainability goals (e.g. through student and community participation, professional development, changing operations and practices in schools) (Mathie & Wals, 2022, p. 5).

Learning environments for sustainability

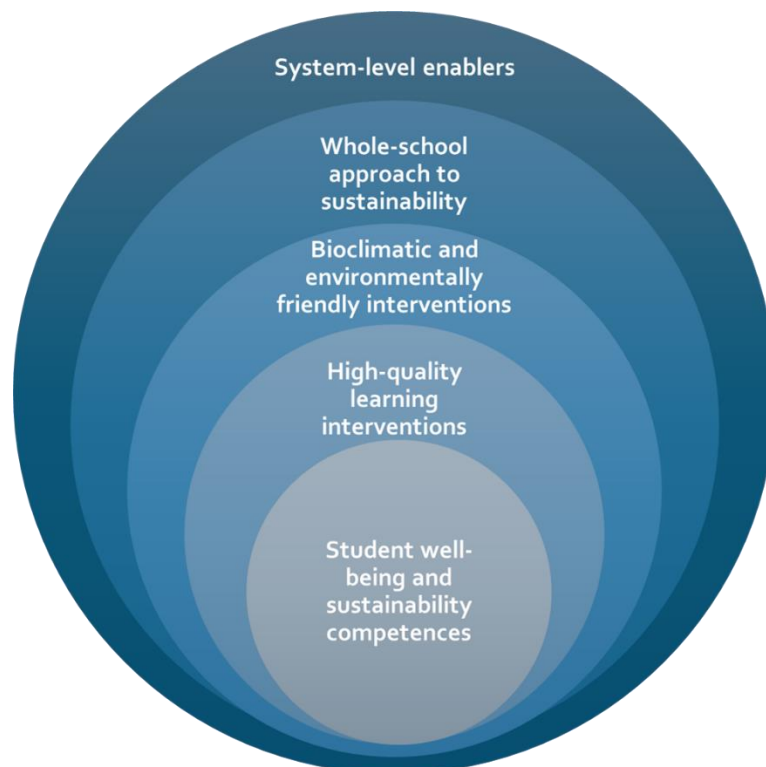
This study defines **learning environments** as follows: the built environment, as well as the natural, digital, psychosocial and pedagogical environment that is accessible inside and outside the classroom *within the campus area*. While we acknowledge that the digital learning environment is accessible from home too, the focus of this study is on what can be accessed within the classroom and on the school grounds.

Learning environments *for* sustainability support “teaching and **learning for sustainability** by encouraging engagement and connection with others as well as the environment and by inspiring hope and new visions or possibilities for a sustainable future” (Tilbury, 2023, p. 7). Such environments:

- (1) **are sustainable**, by following **environmental and bioclimatic principles** (e.g. by integrating green infrastructure solutions that capture carbon and improve air quality);
- (2) follow **interventions for high-quality educational facility** (e.g. paying attention to lighting, noise and accessibility); and
- (3) implement **the whole-school approach to learning for sustainability** across teaching, operations and management.

Error! Reference source not found. summarises how these approaches collectively influence the outcomes of interest in this study – sustainability competences and well-being for students and the planet. Learning environments for sustainability are at their best when **system-level enabling factors** are in place, such as external support and funding being available to teachers and education staff to maximise the benefit of the spaces and practices in schools and to ensure their longevity through upkeep and monitoring.

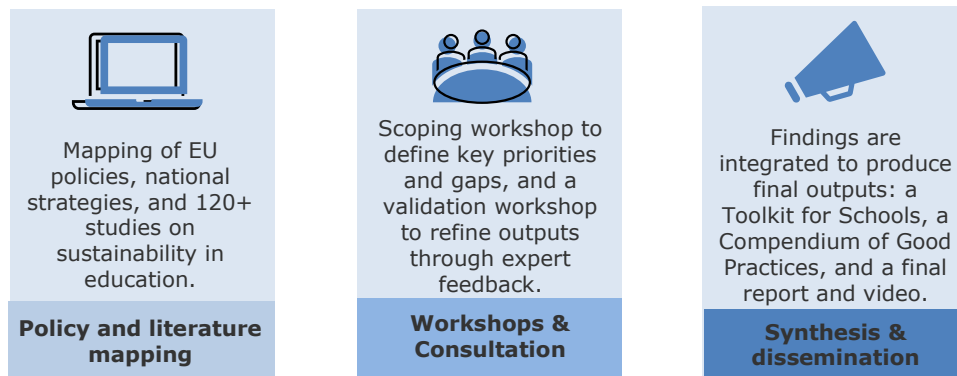
FIGURE 1. KEY COMPONENTS OF LEARNING ENVIRONMENTS FOR SUSTAINABILITY



Source: PPMI (inspired by Barrett et al., 2017; Mathie and Wals, 2022; BREEAM, n.d.; Green Building Consultation and Engineering, n.d.).

2.3. Methods

The present study adopts a **qualitative, mixed methods approach** to explore **the intersection of learning and building for sustainability**. Its mixed-methods design allows data to be collected and analysed using various data collection tools. The aim of this approach is to ensure triangulation of different types of data (literature review, policy mapping, case studies, etc.) A **participatory and iterative approach** helped to pin-point **practical and applicable findings across different educational contexts**. The visual below provides an overview of the study's three methodological phases:

FIGURE 2. THREE METHODOLOGICAL PHASES

The initial phase consisted of reviewing academic literature, EU policy documents and national strategies to map existing knowledge and regulatory frameworks. More than 120 peer-reviewed studies on bioclimatic design, energy efficiency and pedagogical innovation were analysed. National policy documents and local practices were reviewed to **capture variations in sustainability approaches between Member States**.

One of the limits to the literature review was that standardised indicators on sustainable learning environments, such as the proportion of environmentally certified schools, were not consistently available across all Member States. Thus, this report relies instead on proxy indicators and expert assessments. Even so, not all data obtained are comparable, and variations in the availability of data complicate cross-country comparisons.

The initial phase concluded with a **comparative analysis and synthesis** of the data collected through the mapping exercise. This was achieved through a **cross-country overview of** how EU Member States support sustainable learning environments at national, regional and institutional **levels of policy and practice**.

Next, eight diverse case studies were selected from different regions, as well as different scales and types of sustainability projects. These case studies were prepared on the basis of evidence from interviews, site visits and document analysis. Based on these findings, the study team created a toolkit for schools using research, case study insights and stakeholder feedback. The team also collected and presented inspiring practices in a compendium of good practices.

A series of participatory workshops and consultations shaped the project's outcomes by refining research priorities, collecting stakeholder insights, and ensuring the final outputs remained relevant and actionable:

- A **scoping workshop** (March 2024) was attended by experts in sustainable learning environments, architecture and education, to establish research priorities and define gaps in existing knowledge.
- A **validation workshop** (November 2024) provided a platform for experts to review and refine the study's conclusions and recommendations. Key takeaways included student agency, monitoring and evaluation metrics, and the need for practical, scalable sustainability interventions.

The study produced four key outputs: the present report, a collection of case studies, a toolkit, and a compendium of good practices. The table below outlines the objectives and scope, as well as the participatory and iterative development process of the key outputs.

TABLE 1. DEVELOPMENT OF OUTPUTS

OUTPUT	OBJECTIVE	SCOPE	DEVELOPMENT PROCESS
Case studies	To develop eight case studies on inspirational approaches to sustainable learning environments.	Selected studies reflected geographic diversity, scales of intervention (school-level vs. policy level), and innovative sustainability approaches.	Data were collected through site visits, interviews with school leadership and policymakers, as well as document analysis. National experts provided country-specific reports in order to understand the contextual factors influencing the implementation of sustainable practices.
Toolkit for schools	To provide practical guidance on how to make school infrastructure and learning environments more sustainable and supportive of learning for sustainability.	Structured around stages of the learning environment cycle (retrofitting new buildings, classroom spaces)	Developed through desk research, case studies and stakeholder feedback. Insights were gathered from the scoping workshop (March 2024), validation workshop (November 2024) and expert reviews.
Compendium of good practices	To showcase inspirational examples of policy and institutional approaches that integrate sustainability into learning environments.	Presents 23 examples selected based on impact on sustainability, learning and well-being.	Built from 66 documented practices, sourced via a call for proposals, literature review, national expert input and desk research.
Final report	To synthesise findings, conclusions and policy recommendations from all project components.	Integrates insights from case studies, toolkit development, and the compendium of practices across participating countries.	Drafted iteratively, incorporating evidence and feedback from project stakeholders, workshops and expert reviews.

The final phase involved synthesising findings, validating results, formulating recommendations and developing communication materials to support future policy and practice. A short video containing the findings was produced for educators, policymakers and the general public.

3. Design for impact: how sustainable school spaces support learning, health, well-being and the environment

3.1 Linking sustainability and well-being in learning environments

Promoting sustainable spaces in schools is important for environmental and learning benefits, and a growing body of literature and practice highlights their influence on well-being. Sustainability and well-being goals interact in complex ways, sometimes reinforcing each other; at other times coming into tension.

Evidence supporting the proposition that sustainable school environments can positively impact student well-being shows that environments which offer clean air and water, access to green space and opportunities to connect with nature can improve key health and well-being indicators, including quality of life and life expectancy (EEA, 2022; EEA, 2023; WHO, 2022; McMahan, 2018).

Green spaces in schools have been shown to have a positive impact on students' physical and mental health. Access to natural environments encourages physical activity, which supports healthy development and improves overall physical well-being, while also reducing stress and anxiety (Chawla et al., 2014). Moreover, these spaces can be integrated as **practical environments or "living laboratories" for sustainability education**, helping students to learn through direct experience (Fuller et al., 2007). For example, outdoor lessons can involve observing local biodiversity and include hands-on composting or gardening. **Green school elements in infrastructure**, such as schoolyards and outdoor classrooms, support these pedagogical approaches while also reducing stress and boosting emotional resilience among students (Chawla et al., 2014).

Nature-based breaks and outdoor learning help to restore students' focus and attention, contributing to improved learning outcomes. This can directly enhance self-esteem and self-efficacy – key components of well-being (Kaplan & Kaplan, 1989; European Commission, n.d.). Nature-based play and exposure to biodiverse environments have also been shown to **support sustained attention, improve mood and reduce anxiety among students** (Swank, 2024). This is because environments provide a multisensory experience, which can stimulate curiosity and engagement while reducing stress through physical movement, natural light and calming sounds (Ulrich et al., 1991). However, to fully integrate these benefits, outdoor and nature-based spaces need to be **intentionally combined** with teaching and learning practices. For example, literacy activities can involve nature-inspired storytelling or reflective writing in outdoor settings, while art and design projects can draw from the textures, colours and patterns found in the natural environment.

Adequate **temperature, air quality and natural light** can also impact well-being. For instance, students are better able to regulate sleep/wake cycles if these conditions are guaranteed, and evidence links this with lower absenteeism, improved mood and better learning outcomes (Rea, Figueiro, & Bullough, 2002). With regard to **classroom acoustics**, noisy classrooms may hamper the understanding of speech, and therefore teaching and learning (Crandell & Smaldino, 2000; Picard & Bradley, 2001). Optimal **noise levels** are crucial for understanding speech, ensuring the inclusion and well-being of neurodivergent students, who require rooms designed with spaces that minimise noise (Wood, 2018).

Moreover, in addition to the high quality of indoor environments, schools that are **well-adapted to the risk of natural disasters** are known to show higher levels of student attendance and teacher retention (Barrett et al., 2019; Cuyvers et al., 2011). Supporting disaster-preparedness and accessibility creates more resilient learning environments and

contributes to both the real and the perceived **sense of safety** in the school community. Examples of preparedness include evaluating and strengthening school buildings to meet safety standards in seismically active countries such as Greece or Romania, or implementing heat-resilient building design and flood protection measures in schools located in low-lying regions.

Well-being includes both a person's actual experiences and how they perceive their life overall. In research, it is often measured through self-reported assessments (Voukelatou et al., 2021). **Higher subjective well-being relates to higher academic performance**, suggesting that subjective well-being is an important aspect of a student's academic life. It also suggests that more attention should be paid to those students who display poor academic performance (Chattu et al., 2020; European Commission, 2022). Educational performance depends on the presence and **well-being of both students and teachers** (Barrett et al., 2019).

Sustainable learning spaces are closely connected with **encouraging creativity, student agency and self-expression**, which in turn can support a wide range of aspects of well-being, including physical fitness, emotional resilience, mental health, confidence, agency and empowerment (Durham Commission on Creativity and Education, 2019). By integrating elements that encourage creative expression (e.g. art rooms and art supplies, or games for practising creativity) or by giving students direct opportunities to design their own school spaces and suggest improvements, students feel more included, have a stronger sense of belonging, and develop more hands-on skills.

In addition, engaging learners in **pro-environmental behaviours**, such as recycling or taking care of green spaces, has been linked to increased happiness and subjective well-being (Tapia-Fonllem et al., 2013; Capstick et al., 2022). These actions often satisfy intrinsic psychological needs such as autonomy, relatedness and self-determination (Kasser, 2017). These behaviours help students to reimagine their spaces, which strengthens their sense of belonging and emotional connection to their school environment, which in turn is beneficial to their mental and social well-being.

The Gantofta school in Sweden demonstrates how a school adopting circularity principles into its practices positively impacts the overarching school culture. Students report that one can be oneself at the school, and that it is a "**kind school**". Due to the school's positive focus on circularity principles, it has become **normalised to wear second-hand clothing**. A few students who recently transferred to the school from another school commented that in their previous schools, they felt more pressure to wear fashionable and new clothes; conversely, at Gantofta the risk of getting bullied for wearing second-hand clothes was lower. Gantofta was seen as **more inclusive overall, with less bullying and more healthy lifestyles** (e.g. fewer energy drinks and tobacco were visible in the school environment) compared with other schools.

Despite all of these benefits, evidence describes various tensions and challenges to the link between sustainability and well-being. One challenge relates to the **different timeframes** in which these two goals usually operate. While efforts to promote well-being often focus on addressing students' present needs such as comfort and safety, sustainability goals focus on long-term outcomes, such as environmental preservation and intergenerational justice (Dolan et al., 2006). This mismatch can sometimes lead to one goal being prioritised over the other by those in decision-making roles (e.g. school leaders, teachers or policymakers), particularly when short-term actions aimed at boosting immediate satisfaction or comfort are prioritised over longer-term sustainable solutions. For example, a school might choose to install energy-intensive heating or cooling systems to improve current classroom comfort without fully considering their environmental impact, or exploring greener alternatives.

Also, while nature-based spaces provide cognitive and emotional benefits, these effects may **not be equally distributed** across all learners (Dolan et al., 2006). To ensure that the advantages of sustainable environments are accessible to all students – regardless of socio-economic status and cultural background – sustainability interventions should be designed with **equity perspectives** in mind. This includes identifying and addressing potential barriers that might limit participation or access for marginalised groups, and providing support to meet diverse student needs.

Among unintended effects, there is growing concern about **eco-anxiety**, particularly among young people. An excessive focus on environmental issues without adequate emotional support can trigger fear, hopelessness and even mental health issues such as insomnia and depression (Galvin, 2023). Therefore, sustainability education must be balanced with emotional tools that foster agency, resilience and constructive engagement (Lutz, Zelenski, & Newman, 2023). Moreover, not all sustainable interventions benefit well-being. For instance, green spaces may be less effective at reducing stress when implemented in isolation, and often need to be **combined with targeted socio-emotional support** to maximise their positive impact (Cordova et al., 2023). Given this complex relationship, education systems and schools must reflect comprehensively on the **potential benefits of sustainable environments** while also considering the **barriers and enablers in each specific context**.

This study aims to bridge both of the following key tensions: (1) the need for learning spaces to be sustainable and contribute to the well-being of others, the environment and future generations; and (2) the need for learning spaces that enhance individual well-being and learning in the present. Several promising practices are emerging from schools and communities, which seek to integrate both goals. The examples that follow, drawn from fieldwork, make such learning spaces more influential in improving well-being, while providing evidence on what the key factors are that mediate this relationship.

For example, **outdoor learning and the integration of nature-based solutions (NBSs)** in schools can increase students' sustainability awareness and competence, and have the potential to improve well-being (Aavik & Dobewall, 2017). NBSs go beyond the inclusion of green spaces by using natural elements to address pressing environmental challenges for schools, such as urban heat islands, poor air quality, carbon sequestration, and water runoff. Schools can implement NBSs to address these challenges through green roofs, living walls, rain gardens and permeable pavements. These elements can support temperature regulation and water management as well as reducing energy consumption, while serving as learning environments for sustainability (Climate ADAPT, 2024).

Evidence from a school in the **United States**, finds “a positive correlation between time spent outside and feeling energetic, and a negative correlation with feeling angry, confused, or tired and with total mood state after students participated in an outdoor learning experience” (Swank, 2024). Outdoor learning includes a broad spectrum of activities such as field trips, outdoor visits to community projects and adventure education – all of which promote personal growth, critical thinking and cross-disciplinary learning in complementary ways (Rickinson et al., 2004). Research indicates that **outdoor learning positively influences student well-being, environmental awareness and academic outcomes**.

The Keplero Secondary School in **Rome** demonstrates this dual usage of NBSs in daily school life. Its approach aligns with evidence that modern schools should be designed as “healthy everyday landscapes” that integrate natural spaces and encourage contact with nature, improving children’s physical and mental health (Trojanowska, 2019):

This school has transformed its outdoor spaces into interactive and vibrant learning environments in which students engage with nature and sustainability as part of their daily school life. Through hands-on activities and outdoor learning in the vegetable garden, green roof, and unique outdoor spaces Zome and Dome, students connect with nature, develop environmental awareness and gain practical knowledge of biodiversity and sustainable food systems – all while benefitting from time outdoors. These areas provide flexible, calming spaces for enquiry-based and experiential learning, supporting students’ learning outcomes as well as their and mental and emotional well-being.



Conversations with students reveal their enthusiasm, commitment, responsibility and sense of belonging to their school. This sense of ownership strengthens their self-esteem, confidence and connection to the school as students of different ages collaborate to improve their environment through participatory activities.



Source: own – taken by research team during the field visit.

3.2 Sustainable spaces and learning

Studies have shown that the **quality of school infrastructure positively impacts children’s learning outcomes**. Although causal evidence is rare, non-experimental studies strongly support these findings. Critical characteristics for quality school infrastructure are **safe** and **healthy** places (reasonable distance to school; relatively small; quality outdoor and indoor environments), the physical characteristics of learning spaces (good natural conditions such as light or air quality, flexibility and connectivity, consideration of the local climate and cultural conditions), pedagogical practice, and participatory design involving multiple stakeholders and relationships with the wider community (Barrett et al., 2019).

Nature experiences can have profound benefits for children’s learning. At Arany János Elementary School in Szeged, **Hungary**, a school garden introduced in 2016 has improved school life by reducing noise and air pollution while enabling outdoor and community-based learning. A similar initiative can be found at Majorana-Maitani high school in Orvieto, **Italy**, where a “Disconnection room” has been introduced. This space exemplifies how the principles of individualisation and stimulation can be seamlessly integrated into daily teaching practices – through modular desks to encourage interaction and collaboration between students, and a relaxation area – while adopting more flexible approaches to teaching, as well as promoting social connections, and reconnecting and focusing on environmental issues.

Similarly, integrating **natural elements into classroom** settings, such as potted plants or a green wall, has been shown to contribute to greater attention among students (van den Bogerd et al., 2020). A primary school in Luxembourg prioritised local ecological materials and acoustic quality, employing wood and acoustic felt panels to contribute to a

good sound environment and acoustic. In another, more long-term, study on elementary school children, an evaluation of the restorative impacts of green walls containing living plants in classrooms revealed that children achieved higher scores on a test for selective attention, as well as more positive classroom evaluations, compared with a control group (van den Berg et al., 2017). Also related to indoor nature are window views of nature, which have a similar psychological effect on those looking outwards. In one study, natural window views in classrooms were associated with lower perceived stress levels and better attention from pupils (Lindemann-Matthies, Benkowitz, & Hellinger, 2021).

However, learning environments for sustainability do not emerge by themselves, but need to be actively shaped by their users. High-quality learning environments that embrace **individualisation, stimulation and innovation** and consider equity, inclusion and accessibility in their design have even more positive impact on student learning outcomes. Hence, meaningful engagement and collaboration, together with community integration, foster a sense of belonging, extend learning beyond the school setting, and contribute to creating and sustaining learning environments for sustainability, fostering sustainability competences, and ultimately shaping a more sustainable society.

Working with the school environment through the whole-school approach in order to foster experiences and culture (including social norms and peer pressure) can be a particularly powerful approach. This requires working with pedagogies or approaches that actively engage students in the learning environment (Tucker & Izadpanahi, 2017) and designing learning spaces (e.g. in terms of the layout, orientation and seating of the students, use of equipment that is adaptable and flexible) that help to enhance and support quality engagement and pedagogies for sustainability.

Furthermore, sustainable schools play a fundamental role in cultivating **sustainability competences** among students. Empirical studies indicate that students who learn in sustainably designed schools exhibit higher levels of ecological literacy and are more likely to adopt pro-environmental behaviours compared with their peers in conventional school buildings (Hofverberg, 2023). Participation in initiatives such as school gardens or outdoor learning areas has been shown to reinforce students' problem-solving abilities and ecological stewardship (Tucker & Izadpanahi, 2017). Learning environments must therefore not only support academic development, but also serve as living laboratories in which students engage directly with sustainability practices through participation, reflection and co-creation.

3.2.1. Student participation

Participatory approaches to designing and managing school spaces are part of this process. **When students are trusted to care for their immediate environment, they experience first-hand the relationship between everyday actions and larger ecological systems** (Andreou, 2020). This helps them to **develop political agency around environmental issues**, which is necessary for generating **collective, community-level sustainability action** (Salama, 2009). However, the extent to which these experiences translate into deep, transferable sustainability competences depends on the **quality, inclusiveness and continuity** of participation.

Therefore, meaningful engagement should be designed horizontally across all phases of the development and utilisation of learning environments for sustainability. There is consensus regarding the importance of **collaborative planning and decision-making in the design process**, and an emphasis on the **users' experience** of learning environments throughout the design, evaluation and use of spaces (Salama, 2009). This can be referred to as the participation of children and young people in policy and planning processes through **"everyday knowingness"** (Horton, Hadfield-Hill, & Kraftl, 2015). By

empowering students to have a voice in the design of their learning environment, educators and architects can create spaces tailored to their **needs and preferences**, fostering a **sense of ownership and belonging**. When students are empowered to co-create their spaces, learning becomes more relevant, experiential and impactful. The **Cours Oasis** programme below illustrates how student participation and engagement can advance **sustainability competences**:

The initiative **Cours Oasis** in **Paris, France**, transforms traditional school courtyards into multifunctional, sustainable outdoor spaces. These transformed spaces allow students to engage with sustainability topics through hands-on activities and experiential learning.



Diagnostic plan of the children's use of the courtyard.

Source: CAUE de Paris.

Co-design is one of the cornerstones of the *Cours Oasis* programme, since it ensures that each courtyard transformation is tailored to the school's needs. The process involves students, teachers, school administrators and parents at every stage. Each project begins by presenting its goals and challenges to the school community. Students play a central role in this process, **participating in workshops to explore sustainability, describe the current use of the courtyard and brainstorm ideas**. These sessions resulted in a wish list in which participants articulated their aspirations for the space to be developed. A **pedagogical toolkit** is provided to the schools to support educators in integrating these discussions into the classroom. This suggests that participatory design maximises educational impact when embedded into the school's **physical fabric and pedagogical strategy**.

Nevertheless, the success of participatory approaches is shaped by broader contextual factors. A report on citizenship education in Belgium, involving 162 secondary schools and almost 3,000 students, found that such engagement is influenced by the following factors: **the school's organisational culture, the availability of support and resources for student-led initiatives, and the extent to which students feel empowered** to voice their ideas and contribute to decision-making processes (Sampermans et al., 2017).

In addition, individual student attitudes and motivations towards sustainability play a role in determining their level of engagement. This finding is illustrated by a high school project in **Bratislava**, in which students participated in designing a reading room and a study room. Through a participatory approach, the students developed an idea to create a shared space for meeting others, and a separate area dedicated to studying. They contributed their ideas and, in collaboration with the architect, developed a concept that blended practicality with aesthetics. Although the outcome benefitted the broader school community, only a small group of students participated in the design process, which underlines the challenge of achieving broad participation.

3.2.2. Multifunctional and adaptable classrooms

The traditional classroom setup of desks and seating arranged in rows, oriented towards the teacher, has been long criticised as ineffective, too centred on the teacher figure, and failing to deliver learning outcomes (Baker, 2012). Several concepts, such as **adaptable and multifunctional classrooms**, attempt to remodel and rethink the traditional

classroom layout and the teaching approaches that are coded within it. It is important to note that learning spaces do not have a direct causal effect on producing a change in pedagogy (Bissell, 2002) – but, as one study puts it, the “process of effecting pedagogic change ‘in’ contemporary learning environments is a relational achievement drawing on diverse social, discursive and material resources, including physical learning spaces” (Mulcahy, Cleveland, & Aberton, 2015). In other words, classrooms that empower the use of a wide range of pedagogies allow educators greater flexibility in their approach to teaching, which is the outcome of various other factors (e.g. curriculum changes). Classrooms that are designed for flexibility and interaction encourage problem-solving and participation, evidencing the connection between learning and real-world environmental action.

Tailoring the learning environment to meet the diverse needs of students fosters a sense of **ownership**, whereby learners feel responsible for their surroundings (DeVries & Zan, 1994). For instance, it is argued that intimate and personalised spaces are better for absorbing and memorising information (McMillan, n.d.). Adaptable classrooms that are **flexible** and versatile learning spaces can accommodate diverse teaching methods, pedagogical approaches and student needs. For younger students in particular, providing havens or structured spaces within a room can help to ensure a sense of security (Arndt, 2012). Approaches to learning and teaching that provide space for learners to be creative or to explore their creativity (e.g. art rooms and art supplies or games for practising creativity) could also be crucial to improving their well-being and learning outcomes at school. **Activity-permissible classrooms** support active engagement and movement for learning (Kilbourne, Scott-Webber, & Kapitula, 2017) since they are designed to accommodate a variety of pedagogies and educational activities, including group discussions, project work and hands-on experiments, with a stronger focus on movement compared with adaptable classrooms.

A balanced level of **complexity** in the physical setting supports concentration by avoiding visual overload. Similarly, thoughtful use of **colour** can influence mood and cognitive function (Fisher, Godwin, & Seltman, 2014). Research on the impact of colour on learning shows that bright colours can boost student performance and energise students, while more calming colours may help to reduce stress and support concentration. These effects are also shaped by individual psychological responses and cultural associations with colour. Therefore, creating a learning space that is visually coherent and sufficiently stimulating without becoming overwhelming can help maintain students’ attention and motivation.

Equity, inclusion and **accessibility** are crucial factors that should also be a part of the design of a sustainable learning environment. These involve making the school grounds accessible and tailored to persons with disabilities (universal access), neurodivergence, or people with mental and physical health issues. Another dimension relates to cultural inclusion, reflecting diverse cultural identities in both design and teaching, as well as social equity, ensuring equitable access to quality facilities across different regions or socio-economic contexts. While inclusion and accessibility are increasingly important in the design of indoor learning environments, less attention is paid to them when designing green schoolyards. To address this, the Children and Nature Network has prepared various materials on connecting children of all abilities with nature play and therapeutic gardens (Children and Nature Network, n.d.).

Overall, providing learners with opportunities for new experiences and using different approaches and tools can help to attract learners’ attention and keep them active and productive throughout the day. In alignment with the principles of high-quality learning environments outlined previously, research shows that well-designed learning environments that combine optimal physical conditions with innovative and inclusive design have a **positive impact on academic performance, and foster sustainability**

competences (Yemini, Engel, & Ben Simon, 2023). In such environments, when learning for sustainability approaches are applied, students benefit across a range of areas, including science skills, literacy, citizenship, collaboration, communication and leadership. Effective learning for sustainability pedagogies empower students to connect with local and global communities, contributing to real-world solving skills and critical thinking (European Commission, 2025).

3.2.3. Schools as shared community learning space for sustainability

Schools can serve as shared community spaces that provide learning opportunities outside the school boundaries, not only to learners but also to the whole community. **Community integration** and connection are vital for shaping and influencing formal and non-formal processes. In this way, learning can reach out to and involve stakeholders with a role in transitioning communities towards sustainability. Conversely, community participation can immerse students within local ecosystems, cultures and communities and shape them towards being more sustainable. For example, school gardens can play a crucial role in preserving local biodiversity and fostering a sense of responsibility and environmental stewardship – thereby becoming community gardens. Projects on the school grounds or in the local community offer opportunities for curricular, cross-curricular or extra-curricular outcomes (e.g. after-school programmes), either through engagement with local organisations or authentic partnerships that extend learning to real-world settings.

The transformation of learning environments into spaces that support ecological responsibility, sustainability competences and student well-being depends on collaboration between schools, governments, civil society and the private sector. In some Member States, partnerships with industry experts, universities and NGOs have provided schools with hands-on learning opportunities in sustainability. For instance, in Austria, Kandlgasse school collaborates with TU Wien and the Green Cool School initiative to integrate green spaces into the learning environment, which allows students and teachers to link lessons across multiple subjects with practical experiences in their urban ecosystem.

Partnerships for sustainability on the school grounds can take a form of collaboration with parent associations, NGOs or other stakeholders from a local or national setting. These partnerships also involve collaboration between teachers and/or students within a school. Such collaboration partnerships strengthen the school's capacity to **implement sustainable practices in its daily operations**. However, the extent of participatory sustainability management varies across Europe. In Czechia, for example, only 7 % of schools provide students with opportunities to continuously monitor energy consumption, and just 5 % allow similar monitoring of water use. Furthermore, only 9 % of schools involve students in assessing the environmental impact of school operations, while 21 % engage students in decisions about making school spaces more ecological. Stronger institutional support for collaboration between schools and external sustainability experts offers a path towards addressing these disparities. For instance, professionals from environmental organisations, green industries or academia could participate in school sustainability efforts through mentorship, workshops or joint initiatives that help to integrate sustainability competences across the curriculum and support a whole-school approach that integrates learning, practice and values throughout the school culture.

3.2.4. Digital tools for support and learning through spaces

Educational experiences benefit from the integration of technology and creative approaches. **Technology, new experiences** and tasks that bring out learners' **creativity** can be ways to motivate and engage learners. Many schools use digital tools and virtual platforms for learning, such as tracking green data, mindfulness applications or virtual outdoor explorations. Ensuring that the digital tools and platforms used in learning environments are not only accessible but also adaptable to a variety of learning styles

fosters inclusion and participation in digital spaces. Digital technologies, including online collaboration tools, smart classroom systems and virtual learning environments, can further enhance sustainability education and help students to develop the key competences needed in a technology-driven world. **Digital tools** can expand access to resources and facilitate connections beyond the classroom (See subsection **3.2.4**).

For example, solar panels on the school roof can provide an opportunity to introduce real-world examples into teaching practices. A school could display energy data from the PV panels in common areas. One physics teacher from a Bratislava secondary school suggested that having such a practical tool in their classes could lead to building key sustainable competences, particularly critical thinking, adaptability and environmental literacy.

3.3 Sustainable spaces and environmental impact

Research shows that integrating sustainability principles into school design, operation and educational practices **positively impacts energy efficiency, climate resilience and student well-being** (Mahmoudi, Hosseini Vahdat, & Seifi, 2021). Integrating sustainable infrastructure into schools has demonstrated benefits across **environmental, economic, social and educational dimensions**. One of the most potent ways in which a Member State or national coordinating body can support the green transition is by helping educational institutions to become more sustainable (European Commission, 2023). This pathway relies on drivers and support at national level or key investment partners to enact the required renovations and retrofitting.

To begin with, **energy efficiency** stands out as one of the most measurable advantages. Retrofitting schools with renewable energy systems and efficient insulation, as well as advanced heating and cooling technologies, can reduce energy consumption by between 30 % and 60 % (Le et al., 2018). Similarly, schools that incorporate passive solar design, high-performance windows and photovoltaic systems exceed European Union energy standards by up to 90 % (AGION, 2019). Such improvements are especially urgent, given that a large proportion of European school buildings were constructed prior to the introduction of thermal insulation standards in the 1970s, which means they are poorly adapted to today's more extreme climate conditions (Mulvik et al., 2022). As the impacts of climate change intensify – in particular, heat waves, droughts and heavy precipitation – buildings that lack modern insulation and cooling systems face urgent challenges. For example, urban schools in Italy, Spain, Greece and France are disproportionately affected by the urban heat island effect, with 5 % being located in areas where temperatures are more than 4°C higher than the surrounding regions (European Climate and Health Observatory, 2024). These higher ambient temperatures drive up demand for cooling and its associated energy costs.

While overall demand for heating in Europe has declined due to milder winters, projections show that demand for cooling, especially in Southern and Central Europe, is rising sharply. Importantly, cooling is more expensive than heating, which could further strain energy budgets in schools if mitigation measures are not adopted (European Environment Agency, 2016). Retrofitting and redesigning schools to include **green infrastructure** would allow them to offset these rising demands for cooling. Features such as green roofs and vertical gardens can help to reduce indoor temperatures and contribute to carbon capture, carbon uptake and improved air quality, which is particularly beneficial for schools in urban settings.

The **economic benefits** of sustainable school design are also substantial. Even though the initial costs of retrofitting or constructing green schools are often cited as a barrier, studies suggest that this higher upfront cost is marginal. Green schools typically cost less than

2 % more to build than conventional ones, and are far more efficient in the long term, using up to 33 % less energy (Kats, 2006). In Croatia, for example, retrofitting schools achieved energy savings of over 60 %, which has resulted in a considerable reduction in operational costs over time (Le et al., 2018). These savings can be redirected toward educational resources, staff or further infrastructure improvements.

Lastly, improvements in **indoor environmental quality** have shown a direct impact on students' health and academic outcomes. Research emphasises that better air quality, lighting and thermal comfort contribute to more effective learning environments. For instance, studies conducted in Denmark show that classrooms with poor air quality can reduce students' cognitive problem-solving abilities by 30 % (Mahmoudi, Hosseini Vahdat, & Seifi, 2021). Thus, by addressing such issues, sustainable designs can contribute to healthier and more productive spaces.

3.3.1. Multi-level collaboration

Achieving meaningful sustainability outcomes in schools requires more than internal effort; it demands coordinated multi-level collaboration. While national or EU-level programmes are essential in making sustainable school infrastructure more economically viable, localised partnerships offer a direct and impactful pathway to improving environmental performance within school settings (European Commission, 2023).

Collaboration between schools and external sustainability experts, including professionals from environmental NGOs, green industries, academia and public agencies, can significantly help schools in guiding and strengthening their sustainability initiatives. Such partnerships allow schools to tap into specialised knowledge and technical skills that may not exist within the school staff. In this way, they can guarantee that sustainability initiatives are well-informed and effective. These kinds of collaborations can take many practical forms.

Landscape architects and sustainability-trained architects can advise on the greening of school grounds or the retrofitting of buildings for energy efficiency. **Environmental NGOs** can support schools through environmental audits, helping them to monitor energy use, water consumption or waste streams. This approach of multi-level collaboration was demonstrated in the case study on the **Masterplan School Buildings initiative in Flanders (Belgium)**. As part of the initiative, architects worked closely with schools, public agencies and government bodies to design buildings that reflected both sustainability goals and the specific needs of school communities. In the case study from the city of Helsingborg (Sweden), local schools were provided with **a contact point and expert** at the city administration, who specialises in education and environmental sciences and supporting schools in this regard.

In addition, schools can benefit from **industry partnerships** that provide tools and support for the long-term monitoring and maintenance of green initiatives. In the case of the Masterplan, maintenance and energy monitoring were designed into the buildings and included in long-term management contracts, which guaranteed the continuation of work towards the sustainability goals even after the construction stage.

Such collaborations should also extend to **community-based sustainability projects** such as establishing on-site vegetable gardens that are managed with local agricultural cooperatives, installing green roofs with the help of urban ecology experts, or setting up carbon capture pilot zones on school grounds through reforestation or soil restoration techniques.

3.3.2. Green procurement

Green procurement emerges as a strategy for integrating sustainability into a school's everyday operations. Schools can adopt procurement policies that prioritise eco-friendly products and services, such as sustainably sourced furniture, non-toxic cleaning supplies, or energy-efficient technology (European Commission, 2023). Thus, schools can reduce their ecological footprints while supporting ethical consumption and locally sourced products.

One impactful area is the procurement of food and catering services. If schools decide to source **organic, locally grown and seasonal produce** for school meals, they can reduce carbon emissions from transport, support sustainable agricultural practices, and offer healthier food options to students. Schools can also partner with local farms to implement **farm-to-school programmes** or maintain **on-site vegetable gardens** that supply ingredients for their canteens.

Another impactful approach is through the reuse of educational materials. In Spain's Castilla-La Mancha region, the local government is coordinating a **Book Bank programme** that allows students to borrow textbooks free of charge, provided they are returned in good condition for reuse by others. This initiative reduces material waste, eases the financial pressure on families and encourages a culture of care and responsibility among students. Beyond textbooks, schools can pursue green procurement through the adoption of recycled paper products, refillable and reusable stationary, or digital learning platforms that reduce reliance on printed materials.

In some cases, it is the **local municipality or city administration that drives this change**. For instance, in Helsingborg (Sweden), the city administration follows a list of priorities when procuring materials or furniture for public institutions. Schools naturally follow this list of priorities as well. Public bodies first need to search for second-hand or recycled materials, and can only buy entirely new materials or products if there are no suitable second-hand or recycled materials ones available.

In this sense, programmes that guide schools towards selecting responsible suppliers can reduce environmental impact and expose students to the importance of ethical and local consumption.

3.3.3. Sustainable architecture

The concept of **sustainable architecture** is sometimes used interchangeably with **green architecture** or **green buildings**. It is linked to ecological or environmental architecture, which can be seen in narrower terms as focusing on the environmental dimension. In this study, we consider sustainable architecture to be an umbrella term, as it captures the environmental, economic and social dimensions (Le et al., 2018).

The principles of sustainable architecture include **energy conservation, the reduced use of new resources, consideration of climate conditions, respect for users and the site, and a holistic approach to the process**. Other considerations to minimise adverse environmental impacts include site development, the careful selection of durable and recyclable materials and high indoor air quality to improve occupant health and productivity (Mahmoudi, Hosseini Vahdat, & Seifi, 2021). Sustainable processes also require cultural considerations while simultaneously addressing aesthetic dimensions, sensitivity to place, financial aspects, and human well-being (Holstov, Bridgens, & Farmer, 2015).

To illustrate how these principles apply in educational settings, the table below maps each principle to its practical application in schools. Using the case studies, it highlights how schools implement energy-efficient technologies, adaptive designs, green infrastructure

and inclusive design strategies. These examples offer concrete evidence of how sustainable architecture can transform schools into efficient, resilient and engaging learning environments.

TABLE 2. PRINCIPLES OF SUSTAINABLE ARCHITECTURE AND THEIR APPLICATION BY SCHOOLS

Sustainable architecture principles	Examples of school application
Energy conservation and efficiency	Schools can adopt energy-efficient designs and technologies to minimise energy use. In Flanders , schools renovated under the Masterplan implement passive solar design, stronger insulation, energy-efficient HVAC systems and on-site renewable energy systems. As a result, over 90 % of retrofitted schools exceed EU energy efficiency benchmarks (AGION, 2019). In Vienna , the GRG7 Kandlgasse initiative combines vertical greenery with PV panels to lower surface and indoor temperatures, which has been shown to reduce energy demand significantly. In Germany, a retrofitted school reduced its energy demand from 275.9 kWh/m ² a ¹ to 36.4 kWh/m ² a after a retrofit with PVs (Reiss, 2014).
Optimising resources	Schools can reduce their environmental footprint by using recycled, renewable and locally sourced materials. They can prioritise durable, non-toxic and reusable materials to extend building lifecycles and lower maintenance costs. For instance, during the last 15 years in Sweden , wooden craft classes have focused on the life cycle of materials, circularity and durability. The curriculum has been updated accordingly, and a country-wide project is experimenting with recyclable plastic in craft lessons instead of wood (Hofverberg, 2023). In Barcelona , the Escolás + Sostenibles initiative supplies schools with necessary resources like compost and mulch to promote a circular economy model between participating schools.
Climate responsiveness	In challenging climate conditions, schools must adopt adaptive design strategies. Tailoring building designs to local environmental demands improves performance and reduces energy consumption. In Southern Europe, schools benefit from green roofs, reflective surfaces and shading systems to mitigate urban heat islands. In Northern Europe, improved insulation and passive heating reduce dependence on energy-intensive systems (Gil-Baez, Padura, & Huelva, 2019). In Vienna's GRG7 Kandlgasse school, the installation of green walls has led to a reduction in ambient temperature of 2°C.
Green infrastructure and biodiversity	Schools can incorporate green roofs, vertical gardens and redesigned outdoor spaces to strengthen their climate resilience and biodiversity. In Spain , through the EU LIFE project myBUILDINGisGREEN LIFE, schools are mitigating climate impacts by installing green roofs, façades and shading elements to reduce indoor temperatures, create shade and improve water retention. A rainwater-collecting system irrigates green areas, while additional trees and automated ventilation systems enhance cooling and air quality. Similarly, Barcelona's <i>Refugis Climàtics</i> project redesigns playgrounds with shaded areas and rainwater management systems to strengthen schools' resilience against extreme weather conditions.

¹ This measure means kilowatt-hours per square meter per year.

Sustainable architecture principles	Examples of school application
Respect for users and sites	Inclusive design processes allow school environments to reflect the needs of students, teachers and the wider community. The Masterplan initiative in Flanders retrofits historical buildings and creates multifunctional spaces. For instance, the Sint-Franciscus monastery now serves as a modern educational facility. BuBaO Sint-Gregorius was designed with quiet outdoor areas and low-stimulus environments to better support students with autism and learning disorders.

Sustainable architecture embodies a holistic approach that simultaneously improves energy efficiency and transforms school buildings into learning environments. This approach aligns with the whole-school model by integrating sustainability into the curriculum, infrastructure and daily life of the school. This integration of infrastructure and curriculum creates a positive feedback loop: as schools improve their environmental performance, they simultaneously cultivate sustainability competences among students.

3.3.4. Bioclimatic principles

Bioclimatic principles for sustainable buildings offer an environmental framework for designing school structures. These principles encompass strategies aimed at conserving resources, reducing pollution and creating healthy, adaptable spaces that align with the natural environment. By responding to local climate conditions, bioclimatic principles help to design school buildings that minimise environmental impact (Enrico De Angelis et al., 2017). The case studies illustrate how measures such as flexible classroom designs, water-saving systems and biodiversity-promoting green spaces optimise building performance and create hands-on learning opportunities for students.

To illustrate how elements of bioclimatic design can be integrated into educational settings, the table below presents selected examples from the case studies. It maps specific objectives to real-world applications in schools, showing how adaptable spaces, water-saving technologies, sustainable transport strategies and biodiversity-focused designs have been implemented successfully.

TABLE 3. BIOCLIMATIC PRINCIPLES AND THEIR APPLICATION BY SCHOOLS

Bioclimatic objective	Examples of school application
Adaptability	Flexible classroom designs can minimise unnecessary construction and waste by enabling multifunctional use. In the Flanders <i>Masterplan</i> , historic buildings were retrofitted to accommodate modern educational needs. Similarly, Rome's <i>Liceo Keplero</i> introduced movable walls and adaptable furniture, allowing classrooms to be easily reconfigured for different learning activities (Hamida et al., 2023).
Water efficiency	Schools can implement rainwater harvesting, vacuum toilets and greywater systems to reduce water waste and operational costs. Schools using efficient water management systems in Ireland save thousands of litres annually (Walton, 2022). Barcelona's <i>Escolas + Sostenibles</i> and Paris's <i>Cours Oasis</i> initiatives integrate rainwater collection both as a sustainability strategy and an educational tool.

Sustainable transport	Schools can encourage eco-friendly commuting by installing bike racks, designing safe pedestrian routes to public transport, and promoting carpooling. The <i>Masterplan School Buildings</i> in Flanders ensures that renovated schools include sustainable transport infrastructure to reduce carbon emissions from daily commutes.
Promoting biodiversity	Schools strengthen biodiversity through green roofs, gardens and native plant habitats. Most case study schools and initiatives have integrated green spaces to foster environmental awareness. For instance, in Vienna , <i>GRG7 Kandlgasse</i> built insect hotels and green spaces, encouraging students to engage with nature while learning about ecosystems. In Flanders , the school Koninklijk Atheneum decided to preserve the local biodiversity of their playground area by planting local plants and reducing mowing to allow natural meadows to form. This initiative increased biodiversity and lowered maintenance costs .

The integration of sustainable infrastructures within educational settings needs to go beyond the isolated application of green technologies. As the case studies reveal, such infrastructures, when embedded within a broader strategic vision, can act as an instrument to foster sustainability competences and drive long-term climate resilience.

4. Trends and developments in EU Member States

Many EU Member States have made substantial progress in drafting policy and implementing initiatives that can contribute to bringing into reality learning spaces for sustainability, along with student well-being and learning outcomes. From defining the vision for school environments and the goals to achieve them in their national strategies for education, to providing funding opportunities, guidelines for schools and opportunities to collaborate – a look into the current achievements of Member States provides a rich and encouraging tapestry on how to move forward. This chapter of the report delves into the different ways in which public policy can help to raise the bar still further.

4.1. Learning environments in national strategic documents

As part of this study, a comprehensive mapping exercise was conducted to examine how – and to what extent – learning for sustainability and related concepts appear in national or regional strategies, laws or standards. The findings suggest that references to the concept appear most frequently in **education strategies**, particularly those that focus on sustainability education. In contrast, strategies relating to **construction or infrastructure** typically do not address school-specific sustainability goals. Instead, they focus more broadly on **energy efficiency targets** for public buildings as a whole.

Only 11 Member States explicitly mention the concept or a closely related term in their national documents. Another eight present objectives and goals that can be perceived as directly supporting the sustainability of learning spaces, but otherwise do not include a conceptualisation of what such an environment is or entails. Member States generally fall into four categories in terms of how developed the idea of a learning environment for sustainability is in their national documents.

In the first category, national education strategies or other relevant documents (for example, strategies for sustainable development or climate change mitigation) do not include the concept of a sustainable learning environment at all, and do not discuss any similar or relevant ideas (although they may discuss the content of education and pedagogical approaches necessary for sustainability). In such cases, even the concept of **learning environments** is not addressed in education strategies. To a certain degree, **all countries** have legal base requirements for school infrastructure quality that can be found

separately and **outside of education strategies** (for example, regulations requiring school buildings to provide a certain minimum space in square metres per student, natural lighting and other features related to the quality of the environment).

In the second category, the concept of **learning environments** is explicitly mentioned in education strategies and is often described as being **of quality**. Such descriptions include considerations of health, safety, inclusivity, modernisation, being digitally equipped and promoting learning. Nevertheless, they do not include sustainability as a key idea, and it is only mentioned indirectly through other attributes.

In the third category are Member States that mention the physical sustainability of education infrastructure in their strategies, but **do not point to the role of sustainable learning environments in promoting learning for sustainability**. In these cases, such environments are most often understood as sustainably constructed buildings that offer environmental benefits (lower environmental impact of construction, energy efficiency, lower emissions), health and well-being benefits, and/or can help the school community to prepare and adapt to climate hazards. There is **no reference as to how they can help students to learn about sustainability** and to develop relevant competences.

Lastly, in the fourth category, strategies **include learning for sustainability as a core element when developing the objectives for sustainable learning environments**. In these cases, the whole-school approach is often the framework used to discuss sustainable infrastructure and learning environments, as these are understood as being crucial to promoting learning for sustainability: objectives for environment sustainability are described in tandem with the need to develop teacher competences, implement curricular changes, and involve the community and learners.

Below, we investigate some examples of the most developed understandings of learning environments for sustainability, and how Member States approach these in their education strategies and action plans. In these cases, learning spaces go beyond physical upgrades to encompass teacher training, curricular reforms and community engagement.

For example, Denmark's **Action Plan for Education for Sustainable Development** (*Uddannelse for Bæredygtig Udvikling*) (Børne- og undervisningsministeren, 2022) contains specific recommendations dedicated to both the physical quality of education facilities, and the conceptual qualities (e.g. inclusivity) of these spaces. The whole-school approach is entrenched in the action plan, which underlines that "green environments and teaching must go hand in hand with a sustainable physical environment in schools" (p.53). In building sustainable physical learning environments, the action plan includes proposals for energy-efficient school buildings, waste recycling facilities, indoor air quality, and the efficiency of building materials, disaggregating these propositions by **which stakeholder group has ownership** over their implementation.

In the case of **Ireland**, the National Strategy for Education for Sustainable Development 2030 sets out five key priority action areas. The second of these is "**Transforming learning environments**" (Government of Ireland, 2022). This action area sets an objective for schools to be places "**where learners learn what they live and live what they learn**". This includes several sub-priorities: to develop and support leadership for learning for sustainability, sustainability competences and transversal skills as core to learning outcomes; to promote and support the use of learning for sustainability pedagogies among educators; embedding learning for sustainability into curricula and programmes at all levels to ensure learners acquire the knowledge, skills, values and dispositions to promote, advance and take action for sustainable development; to enable access to high-quality resources for learning for sustainability; and whole-institution

approaches – transforming learning environments into educational spaces for sustainability.

Another example of a clear reference to the role of sustainable learning spaces for learning for sustainability and a whole-school approach can be found in Spain. The **Spanish education law** (LOMLOE, 2020; Ministerio para la Transición Ecológica, 2021) mentions sustainability several times in the following terms: “Given that the educational system cannot ignore the challenges posed by the climate change of the planet, **educational centres must become a place of custody and care for our environment**. For this reason, they must promote a culture of environmental sustainability, social cooperation, the development of sustainable lifestyle programmes and the promotion of recycling and contact with green spaces” (Preamble). In the same vein, it recognises that “education for ecological transition, with criteria of social justice, is a contribution to environmental, social and economic sustainability.” (Art.1.r)

In Spain’s Action Plan for Environmental Education for Sustainability 2021-2025 (PAEAS) (Ministerio para la Transición Ecológica, 2021), the plan’s key objectives entrench a whole-school approach, as they bring together and holistically discuss the need for curriculum changes; teacher training programmes that align with the needs of change; the promotion of the **re-naturalisation of educational centres** as an exercise in institutional coherence that reinforces educational interventions; and, lastly, the need to design and implement programmes and projects with awareness to the community context of educational centres. Overall, sustainable learning environments are deemed to be a core factor not only in the success of learning goals, but also for environmental well-being.

Another thorough definition of sustainable learning environments is offered in Cyprus, under the National Strategy to Education for Sustainable Development and Green Transition 2030. This document integrates three policies relevant to sustainable learning environments – the “Whole School Approach Systemic Framework for ESD in 2023” (SUSEDI, 2022); the policy for digital education in schools, enacted in 2024 (Ministry of education, sport and youth, 2024); and the policy for developing urban space, strengthening climate resilience and environmental awareness in schools “Greening the school-Greening the community”. In effect, this strategy promotes the roles of **health and well-being**, especially through green infrastructure in schools, which improves air quality. It also stresses that overall student learning and fostering sustainability competences can be achieved through the whole-school approach and experiential learning.

Another interesting initiative comes from Romania. Under a new law on pre-university education, a **methodology for establishing and operating “green schools”** defines them as schools that create a healthy and learning-friendly environment while saving resources, generate their own electricity and using technologies that reduce greenhouse gas emissions (heat pumps, electric buses charged with electricity produced by solar photovoltaic panels, etc.). To qualify as a “green school”, schools must meet all of the following conditions: a) rehabilitated/renovated/modernised or new infrastructure; b) the integration of elements of education for sustainable development/environmental education into the curriculum and extra-curricular activities of the school; c) the inclusion in the school’s management documents and associated practices of measures reflecting an emphasis on the green aspect of the school, including in terms of the digitalisation of processes and content; d) opening up the school to the community, including through the development of partnerships/collaboration/cooperation with relevant community actors in the areas of environmental protection and sustainable development. These requirements include a strong element of the whole-school approach, combining sustainable learning environment objectives with the needs of the community, inclusion and changes in the curricula.

Across Member States' strategic documents, there are also interesting **examples of terms that are adjacent and relevant** to the concept of sustainable learning environment. These show the variety of approaches and paths to achieving goals that align with learning for sustainability. The table below provides an overview of some of the terms mapped and the more original approaches.

TABLE 4. TERMS RELATED TO SUSTAINABLE LEARNING ENVIRONMENTS USED IN THE STRATEGIC DOCUMENTS OF MEMBER STATE

MS	Other related or relevant terms and concepts
BG	Modernisation of school buildings
EE	Diverse learning environment, learner-centred learning, joy of learning
IE	Decarbonising buildings, transforming learning environments
IT	Healthy school environments, green laboratories, innovative learning environments, <i>la buona scuola</i> ("the good school")
LT	The good school
MT	Enhanced learning environment, tomorrow's schools
SE	Well-developed living environments, good-quality environment for development and learning, sustainable outdoor learning environments
SI	Safe and stimulating learning environment, greening of educational infrastructure, quality architecture

Source: Compiled by PPMI, based on analysis of Member State national documents relating to education and sustainability.

The **modernisation** of school buildings is a term commonly used in various countries. In most cases, this includes sustainability goals and ties into the promotion of green competences. For example, in the case of Bulgaria's National Recovery and Sustainability Plan, the reform and investment goals of the "modernisation of educational infrastructure" and "building a school STEM environment" aim to create conditions for equal access to education by building a favourable, inclusive, innovative, supportive and motivating educational environment, and to create more attractive conditions for learning. These also include interventions for repair, reconstruction and renovation, as well as the construction of installations for the use of alternative sources of energy, heating, ventilation and cooling of the building stock, landscaping and other elements. Overall, there is a **strong focus on digitalisation** (e.g. existing classrooms are upgraded through modern technical tools and devices, providing quality internet connectivity and equipment). Therefore, while sustainability is not the primary focus, there are elements relating to the sustainability of infrastructure.

Another interesting example comes from the **Estonian Education Strategy 2021-2035**, adopted by the government in 2021. This strategy sets out goals for a **diverse learning environment** and **learner-centred education**. The main actions proposed include curricula based on learner-centred pedagogies, and the digitalisation of learning materials and methodologies. The **"joy of learning"** – namely, the subjective well-being of both

learners and teachers – is placed at the core of the strategy. The document also highlights the role played by the health and well-being of students and teachers: “The organisational culture of educational institutions is caring, collaborative and democratic, supports the development of general competences and the well-being of all, including better physical and mental health, diversity of views and constructive resolution of disagreements and crises” (Ministry of Education and Research, 2021, p. 19).

Good-quality learning environment is another relevant term. In Sweden, national documents state that “The school must strive to be a **vibrant social community** that provides security and a will and desire to learn. The school operates in an environment with many sources of knowledge. The aim must be to create the best overall conditions for the students’ education, thinking and knowledge development. [...]. Care for the individual **student's health, well-being and development** must characterise the [school's] activities. Every student has the right to develop at school, feel **the joy of growth and experience** the satisfaction that comes from making progress and overcoming difficulties.” The quality of learning environments rests on social efforts and providing students with various knowledge sources – not just on environmental sustainability. The need to harmonise the dimensions of the **social, physical and pedagogical spheres** is understood as helping to define a **good quality learning environment**, and the quality assurance and evaluations of schools’ approaches are the responsibility of all education personnel and students, in close cooperation with the home and the wider society around the school.

Italy, meanwhile, has included both **bioclimatic objectives** and **high-quality learning environments** as tools to counter school dropout in its National Operational Programme 2014-20. In particular, the document refers to the concept of a “**smart school**”, i.e. a school that “meets new **quality standards** from a completely renewed perspective, also with respect to the **functionality** of school environments in terms of **sustainability** and consequent **sensitisation of new generations** about good practices in climate and environmental sustainability” (Programma Operativo Nazionale 2014-2020, 2022).

Portugal provides a noteworthy example of how architectural and educational values can be meaningfully integrated into national standards for school design. The country’s Ministry of Education published a **manual of technical standards** to guide the design of architectural and engineering projects for the creation of secondary schools in 2003, and school centres in 2004. With regard to secondary schools, the guidelines state that “In its entirety, school facilities should constitute a **harmonious whole**, carefully **integrated into the urban and landscape surroundings** and with **good accessibility**. The **quality of architectural design** dignifies the educational function, facilitates school management, induces well-being and good relationships among people, stimulates student academic achievement, and fosters appreciation and respect for the school.” The manual also suggests that schools should be designed from “a perspective of **diversification and versatility of solutions: each school should have its own character**, and all should be equipped with the capacity to adapt, without disruptions and through successive adjustments, to the evolution of pedagogical practices and curricula, and fluctuations in demand.” This example illustrates how standards for the built environment can reflect a broader vision of education that includes **adaptability, well-being and a deep respect for place** – key elements in the development of truly sustainable learning environments.

4.2. Good practice and policy approaches

Many inspiring and effective initiatives towards learning environments for sustainability are already taking place across Europe. Based on desk research and national reports, this section of the report thematically groups good practices, initiatives and policy approaches found in the EU Member States.



Funding opportunities



Networks, certification and
awards for sustainable schools



Sustainable building standards
and regulations



Guidelines for schools



School gardens and green
spaces



Outdoor learning and other
infrastructure for LfS



Educator and school
administrator training and
guidelines for teachers



Training, guidance, networks
and peer learning for architects
and builders

Note: LfS stands for learning for sustainability.

4.2.1. Funding opportunities and support for energy efficiency and renewables

The primary support mechanism available to schools is funding. In addition to existing EU financing mechanisms, **all but four of the Member States have nationally available funding opportunities** that promote energy efficiency and renewable energy in schools. In most of the examples identified, funding for the renovation of school buildings has come as the result of decarbonisation policies towards the mitigation of emissions and sustainability goals. In these cases, funding is allocated for **energy efficiency solutions and the retrofitting of schools** (e.g. in Czechia, Cyprus, Ireland, Italy, Malta, Belgium, Estonia, France, Germany and Bulgaria), or may come in the form of more narrowly targeted financing programmes, such as funding for schools to install **solar panels** (e.g. in Ireland, Greece and Cyprus). Being at the centre of communities and acting as inspirational examples, schools in particular are targeted for development into “nearly zero-energy buildings” (NZEBS) – that is, buildings with very efficient energy performance, whereby the low amount of energy required comes mostly from renewable sources, produced either on-site or nearby (Directive 2010/31/EU).

Energy use remains one of the largest ongoing expenses for schools, particularly for heating and cooling. Improving energy efficiency also supports broader goals related to climate change mitigation and student well-being. Indoor environmental quality – including aspects such as air quality, temperature regulation and lighting – has a direct impact on learning outcomes and health. Yet across Europe, approximately three out of four existing buildings are energy-inefficient, leading to significant energy waste (European Commission, 2020). The energy performance of school buildings varies widely, depending on factors such as age, size, architectural design and the extent of the electronic equipment used. In addition, thermal comfort needs differ between climate zones, with heating being a priority in colder regions and cooling in warmer ones.

In response, there is a growing emphasis on implementing energy efficiency measures, adopting renewable energy technologies, and ensuring thermal comfort in schools. These improvements are increasingly framed within national decarbonisation agendas, which target the reduction or elimination of CO₂ emissions from buildings to help the transition to a low-carbon economy. In other cases, the primary motivation for such investments is enhancing student well-being and learning conditions.

However, in most Member States, policies are designed to address both environmental and educational objectives in tandem, recognising that sustainable, energy-efficient schools are better places to learn and thrive.

In some instances, gaps in the available information make it more difficult to track the status quo and determine what the primary needs are in a given country or region. In Italy, among the 6,343 school buildings surveyed, just 30.7 % had energy performance certificates. Of those, only 5.4 % met class A standards. In response, the **National Plan for Energy Efficiency in Schools**, financed through the 2020 Budget Law and partly supported by the European Investment Bank, allocated EUR 40 million for school renovations (Italian Parliament, 2019). To be eligible, buildings must comply with structural safety norms, and funds are often channelled through energy service companies (ESCOs). According to the non-profit environmental organisation **Legambiente (2024)**, nearly 80 % of Italian cities have implemented energy efficiency measures in schools during the past five years, focusing on upgrades such as **double glazing, roof insulation, boiler replacement, wall insulation, revamping** and (less commonly) comprehensive renovation.

Croatia has also employed EU funding, via the **Operational Programme Competitiveness and Cohesion 2014–2020**, and supported by EUR 205 million from the European Regional Development Fund. This was used to renovate nearly 800 public buildings, including 391 schools, benefitting around 70,000 students and achieving average energy savings exceeding 60 % (Ministry of Construction and Physical Planning, 2023).

Belgium provides both high-level strategic direction and targeted financial support. In Flanders, the **School Building Master Plan 2.0** commits more than EUR 3 billion to build or renovate more than 1,000 schools (out of over 3,000), with a clear focus on climate resilience, sustainable design and effective learning environments. **All new school buildings must meet the BEN** (nearly zero-energy) standard. Complementary subsidies support energy-saving measures including insulation, solar thermal systems, heat pumps and lighting upgrades. Meanwhile, in Cyprus, the **PEDIA project** targets the transformation of 25 school buildings into NZEBs, combining thermal insulation, shading systems, high-efficiency windows, PV systems, smart controls and green roofs (European Commission, 2024). This is envisioned as a pilot for the development of a **long-term energy renovation strategy** for all public-school buildings, introducing a process framework for energy upgrades based on environmental, energy and socio-economic criteria.

National eco-funds and investment centres can play a central role in the process, too. For example, in Bulgaria, the **National Trust Eco-Fund** has funded energy efficiency projects in over 100 schools. These are partially financed through **debt-for-environment swaps** – agreements under which financial obligations are exchanged in return for commitments to environmental protection. In Estonia, the **Environmental Investment Centre (KIK)** provides grants and loans for a wide range of eligible works, from insulation and heating upgrades to renewable installations, smart monitoring systems, solar protection and **eco-friendly building materials** in school construction and renovation projects. In France, The **Fond vert** (“Green Fund”), endowed with EUR 2 billion, supports local authorities in accelerating **the ecological transition of schools** (Ministère de la Transition, 2023). This fund aims to bridge the gap between national ambitions to cut energy use and the fact that only 10-15 % of France’s educational buildings have so far undergone renovation.

Many EU countries have paired energy retrofitting with **targeted investments in renewable energy systems**. This trend is in line with the **Renewable Energy Directive**, which entered into force in November 2023, increasing the 2030 renewable energy target for the buildings sector to 49 % renewable energy by 2030 (European Parliament). For

example, Ireland's **School Sector Technical Climate Action Roadmap 2023-2030** aims to reduce school energy demand through renewable heating systems such as heat pumps, particularly in older buildings. Under the **SEAI Pathfinder Programme**, which has EUR 14 million in funding, a total of 50 schools either had been (or were in the process of being) retrofitted by 2021 (CARO, 2022). Another complementary initiative, the **Solar for Schools Programme**, was launched in 2023 to install rooftop solar panels on public schools, helping to reduce energy bills by up to EUR 1,600 per year (Skujins, 2023).

Greece and Cyprus have made similar moves. In Athens, the municipality is installing photovoltaic systems in 50 schools in partnership with DEDDIE, the operator of the Greek electricity distribution network. **Projected electricity generation will reach 110 %** – more than sufficient to cover the annual consumption of all 300+ schools in the city. Cyprus is investing more than EUR 20 million from its Recovery and Resilience Facility **to equip every school in the country with solar panels**. Other countries are experimenting with smaller-scale or pilot initiatives. In Malta, the Recovery and Resilience Plan provided EUR 10 million in funding for the **Climate-Proofing Malta's Public Schools** project to retrofit two schools. These schools are expected to reduce both energy use and carbon emissions by 60 % through measures that combine energy demand reduction with renewable energy generation.

Beyond direct investments, some Member States are prioritising institutional support and long-term strategic planning. In Czechia, the State Programme for Environmental Education, Training and Awareness recommends developing **a school decarbonisation methodology**, supported by a web platform and guides for school administrators and educators from the Ministry of the Environment, as well as coordination with the Ministry of Education. This support is backed by financial incentives, including grants for building modernisation.

Lastly, another way to support energy efficiency goals is through innovative governance models. In Italy, nearly 90 % of local governments have expressed interest in forming **school-based energy communities** – citizen-led initiatives that allow municipalities, residents and schools to collectively produce and consume renewable energy (Green Agenda, 2020). Rome plans to establish an energy community in each of its 15 municipalities through its FSC 2021/2027 programme, investing around EUR 400 million. The initiative aims to **use public rooftops and school infrastructure to host community energy projects**, developed through collaborative agreements with families, schools and civil society organisations (City of Rome, 2022).

Whether through large-scale public investment, decentralised community projects or experimental pilots, Member States are working to decarbonise school infrastructure while improving learning conditions, reducing emissions and strengthening community resilience. Overall, these approaches emphasise that schools are not just educational spaces, but also strategic assets in the green transition.

4.2.2. Funding opportunities for modernisation, accessibility and disaster-preparedness

Beyond explicitly green initiatives, several funding programmes across the EU Member States contribute to the broader sustainability agenda by supporting school modernisation, improving accessibility and ensuring preparedness for environmental hazards. These initiatives often prioritise disadvantaged communities and address safety and inclusivity as integral components of sustainable learning environments.

In **seismically active countries** such as **Greece** and **Romania**, building resilience against earthquakes is a pressing concern. In Greece, a national project led by the

Technical Chamber of Greece in cooperation with the Organization of Earthquake Design & Protection (OASΠ) focuses on evaluating all school buildings for their seismic safety. Currently, only 6 % of schools comply with the most recent anti-seismic standards from 2001, while many were built under older codes from 1985 or even 1959 – highlighting the urgent need for structural updates.

Romania's **Safer, Inclusive, and Sustainable Schools project (2021-2027)** similarly addresses seismic risk (School and University Network Modernization Project Management Unit, n.d.). Backed by EUR 100 million in funding from the International Bank for Reconstruction and Development, the initiative supports the rehabilitation, consolidation and construction of schools, especially those in high-risk seismic zones. It also aims to increase institutional capacity to invest in sustainable education infrastructure. As of 2023, procurement procedures for design services had already been launched for 22 schools (Ministry of Education, 2023). The country has also leveraged its National Recovery and Resilience Plan (2022) to equip pre-university institutions with modern infrastructure, including furniture, IT equipment, science labs and workshops. While not exclusively focused on sustainability, this EUR 1 billion investment indirectly supports the development of more sustainable learning environments, in particular by **targeting schools in disadvantaged areas** – 2,455 out of 2,545 applications came from such contexts, and a total of 2,538 projects were approved.

Similarly, the **Slovak** government has increasingly invested in the modernisation and improvement of school infrastructure. Through funding mechanisms such as the Recovery and Resilience Facility, elementary schools have access to financial support for constructing, reconstructing, modernising, extending or adding superstructures to school buildings. These projects aim to enhance the **accessibility, safety and environmental quality** of educational facilities, with a particular focus on **energy efficiency and barrier-free access** (Ministry of investment, regional development and informatization of the Slovak Republic, 2022). The funding call includes criteria regarding **energy efficiency**, with the aim of saving at least 30 % of primary energy consumption, as well as **cost-efficiency and environmental sustainability** (Ministry of Education, Science and Research, 2022). Funding aimed at **“de-barrierising”** larger secondary schools seeks to improve inclusion. By removing architectural barriers in at least 182 institutions, the programme seeks to ensure that students with disabilities can enjoy full access to education. Through these funding mechanisms, the Ministry of Education is actively working towards creating sustainable and **accessible learning environments**.

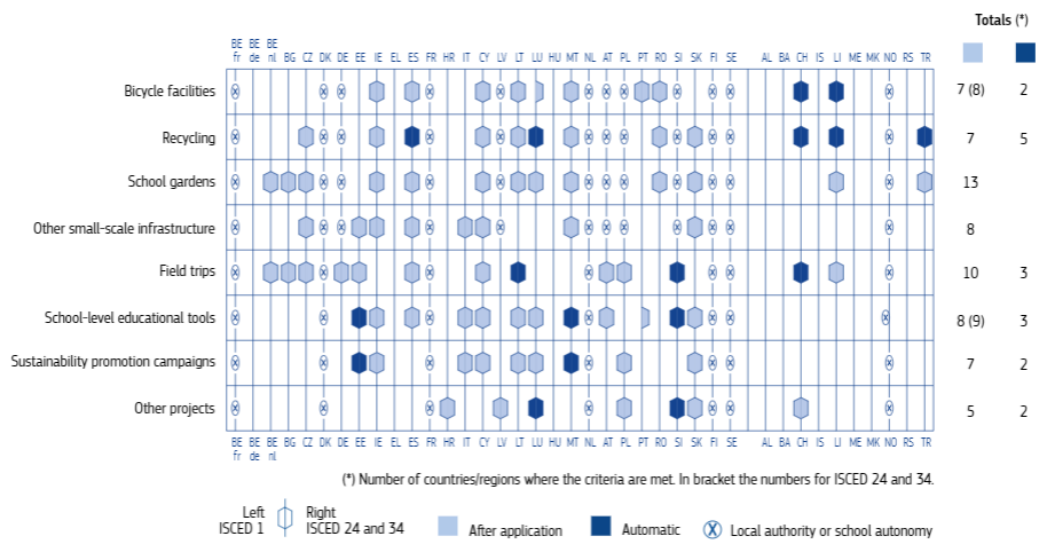
Together, the above examples illustrate how infrastructure-focused investments – while not always framed under “sustainability” – can contribute significantly to the development of resilient, modern and inclusive schools that align with the broader goals of learning environments for sustainability.

4.2.3. Small-scale funding opportunities

Small-scale financial support is also available to schools to support study projects relating to sustainability, teacher training or the development of school gardens. The Eurydice report on “Learning for sustainability in Europe: Building competences and supporting teachers and schools” (European Commission: European Education and Culture Executive Agency, Parveva, T., Birch, P., Horváth, A., Piedrafita Tremosa, S. et al., 2024) maps out the financial support that EU Member State schools can receive for **small-scale school infrastructure** and projects for sustainability (European Commission and European Education and Culture Executive Agency, 2024). These include funding for such objects as **gardens, recycling systems, bicycle facilities and others** (see Figure 3 below).

As is evident from Figure 3, in many Member States, the funding opportunities for such small-scale infrastructure are at times only provided by local authorities or left to school autonomy. The Eurydice report (2024) also specifies whether funding is automatic or requires an application. For example, based on our own mapping, in Spain, recycling infrastructure is a kind of automatic fund, whereas the creation or maintenance of school gardens, cycle paths, playgrounds or educational tools at school level are available on request.

FIGURE 3. FINANCIAL SUPPORT FOR SMALL-SCALE SCHOOL INFRASTRUCTURE AND PROJECTS FOR SUSTAINABILITY



Source: European Commission and European Education and Culture Executive Agency, 2024.

An excellent example of funding for small-scale infrastructure comes from **Ireland’s** Department of Education, which in 2023 allocated more than half a million euros in **funding for Education for Sustainable Development (ESD) projects** in 65 primary and 64 post-primary schools across the country. Grants of between EUR 1,000 and EUR 5,000 were paid to schools for sustainability-related projects such as new school gardens and outdoor classrooms, local air quality initiatives, wildlife trails and poetry for climate action and climate justice.

Another case is found in Denmark, where funding for the Action Plan for Education for Sustainable Development was officially granted through the annual Finance Law (*finanslov*) for 2024, which allocated EUR 1,5 million in 2024 and EUR 2 million in 2025 for **teacher training programmes** and **secondary education initiatives**, respectively (Finansministeriet, 2023). The latter includes specific goals set for promoting sustainable learning environments.

4.2.4. Sustainable buildings standards and regulations for schools

Nearly all EU Member States possess regulations or standards that apply to public buildings, most commonly addressing **energy efficiency**. Many also have **specific provisions for school infrastructure**. These typically cover aspects of student safety, health and well-being such as **air quality, lighting and adequate space** per student. Fewer countries include explicit requirements relating to the environmental sustainability or accessibility of school buildings.

The Danish Energy Agency (*Energistyrelsen*) requires public institutions, including schools, to contribute a 10 % reduction in energy consumption between 2020 and 2030,

in line with national climate goals (Klima-, Energi- og Forsyningsministeriet, 2020). Schools must report annual energy consumption on the Agency's website, promote efficient behaviours, operate infrastructure efficiently, implement cost-effective energy-saving measures, consider renewable energy, and purchase energy-efficient goods and services. In addition, **buildings must obtain an energy label valid for 10 years**, published via official channels.

In Germany, building-related final energy consumption fell by 15.2 % between 2008 and 2022. This is attributed to stringent **efficiency standards** for new buildings and retrofits of old ones (Umwelt Bundesamt, 2024). The Buildings Energy Act (GEG) sets **binding energy performance requirements for both construction and renovation**. The German Energy Agency (DENA) supports these efforts through pilot projects and initiatives such as the *dena-Gebäudereport*, which provides **detailed analyses and forecasts on the energy performance of buildings** (Deutsche Energie-Agentur (Hrsg.), 2023).

Romania's regulations are outlined in the country's NP 010-2022 technical norm, which covers the design and operation of school buildings including high schools and vocational institutions. This technical norm also encompasses various **indoor environment aspects** including air purity, temperature, humidity, lighting level, minimum ventilation rates and maximum air flow velocity (Order No. 1.203/2022).

In **Estonia**, regulations relating to the construction of buildings are listed in the building code and health requirements for schools, as well as in specific acts **relating to each education level**. It is obligatory for schools to follow these. There are accessibility and energy consumption requirements for buildings to control indoor climate and the quality of air, including how to maintain, increase or reduce indoor temperature. From 1 January 2020, all new school buildings must meet the requirements of **near-zero energy**. Similarly to Estonia, Croatia's Long-Term Renewal Strategy of the National Building Fund until 2050 (2020) also states that new buildings for education will be built on basis of the zero-energy principle (Ministry of Physical Planning, Construction and State Assets, 2020).

In Greece, key regulatory documents include the **Guide for Schools of All Levels** and the **Guidelines for the Bioclimatic Design of School Buildings** (2008), issued by the School Buildings Agency. These contain detailed technical criteria by school type and level, covering aspects such as climatic zones, energy-saving interventions, natural lighting and ventilation, passive solar systems, and even **greenhouses** – an uncommon feature among EU regulations.

Slovenia's Ministry of Education and Sports has issued **Instructions for the Construction of Elementary Schools**, with the aim of creating school buildings that are **functional, flexible, healthy, energy-efficient** and **environmentally friendly**, while balancing quality and cost. These guidelines stress the importance of investing in the **quality** of school space rather than merely expanding infrastructure: "we want to achieve pleasant, functional, flexible, high-quality and durable, but not too expensive, buildings for children and teachers, energy-efficient, environmentally friendly, and of course a healthy and safe school building. It should be built in a suitable location and should combine all the previously listed parameters into quality architecture". It is interesting to note that many terms, such as "pleasant" or "suitable location", are subjective and open to interpretation.

A somewhat similar example to Slovenia's can be found at regional level in Spain. The Catalan government developed a **Guideline for building or transforming public schools: new learnings, new spaces** (2021), which requires that the building is energy efficient, reduces energy consumption as much as possible, and uses renewable energy. In choosing materials and solutions, proposed constructions need to take into account the protection of the environment and their impact on the quality of the indoor environment

and the health of the users (Departament d'Educació, 2022). In addition to these straightforward requirements, the guideline also considers the qualities of a space as values that are transversal in all spaces (gender, inclusion, sustainability, health, comfort, safety, etc.) as well as the general characteristics of the different spaces that affect them in specific aspects (ability to be welcoming, connected, flexible, dynamic, open, belonging, multipurpose, simultaneous, transparent, versatile).

Building regulations can also address the **toxicity of materials and the reduction of pollution**. For example, indoor radon gas levels in buildings are a major cause of lung cancer in Europe – a risk increased by exposure to air pollution and tobacco smoke. Although no extensive data exist, energy efficiency measures such as replacing old windows or doors and insulating walls and ceilings can reduce ventilation and make buildings more airtight, which can increase indoor radon levels (European Environment Agency, 2022b). Measures to reduce radon levels therefore require additional measures to ensure proper ventilation.

Another major carcinogen is asbestos. Although an EU-wide ban on asbestos in products sold in the EU was introduced in 2005, particular attention should still be paid to existing built-in asbestos, especially in relation to the EU Renovation Wave, which has triggered a massive wave of building renovations and demolitions. Potentially weak safety measures on site while demolishing or renovating the buildings can increase exposure to asbestos (European Environment Agency, 2022). Portugal has made a concerted effort towards the removal of toxic materials (The Decree-Law 21/2019). By the end of 2020, applications for the removal of asbestos cement had been submitted for a total of 480 schools out of the 578 public schools listed as containing asbestos.

4.2.5. School gardens and green spaces

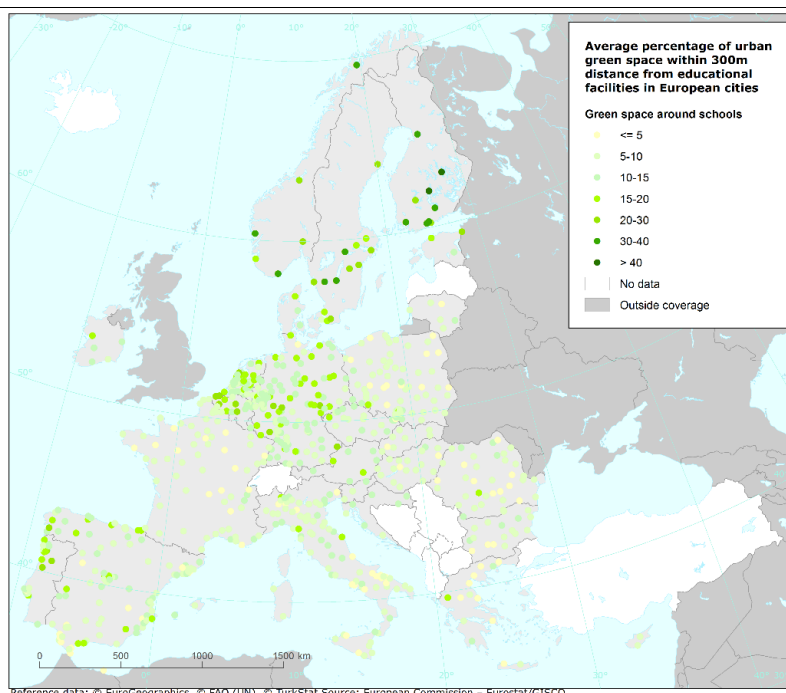
Across the EU, there are great differences in students' access to green space. The map below (Figure 4) illustrates the urban green spaces and schools within cities and their commuting areas that are within 300 metres of educational facilities. On average, just over 10 % of the area within a 300-metre radius of educational facilities is green, and only 6 % has tree cover. Northern Europe boasts the greenest school environments. While the map focuses on broader urban green spaces rather than school grounds specifically, it underlines just how important the green infrastructure in schools can be.

Several countries in Europe are targeting the promotion of green spaces on school grounds to improve access to nature. Malta faces a significant challenge, with 49 % of school grounds covered by concrete and other pavement, and 29 % by built areas. This means that soft landscaping (e.g. green space) covers an average of only 22 % of the area of school campuses (University of Malta, 2022). To address this, Malta's Department of Environment (*Ambjent Malta*) has initiated projects such as "Greening Our Schools", aimed at **improving the environmental quality of Maltese schools**. Three public schools have so far benefitted from this initiative, which has involved removing alien plant species, clearing waste material, planting native trees, improving soil quality and installing benches (Ambjent Malta, 2021). In **Italy**, the presence of school gardens is another factor that highlights the differences between various Italian regions. The national average is 7.9 square metres per child, but this drops to 5.3 square metres per child in southern cities, while in the north of Italy, each child has 10.6 square metres of school garden (Openpolis, 2023).

Around 80 % of primary schools in Czechia have a school garden or nature classroom, and many initiatives have pushed for school grounds to be transformed into **natural gardens**. However, around 25 % of schools make little or no effort to maintain eco-friendly grounds, and only 8 % have certified their land as natural gardens. The Czech State Programme for Environmental Education, Training and Awareness recommends issuing calls for financial

support for infrastructure for climate education, and further support for the creation of natural gardens at schools. Non-profit organisations, supported by the Ministry of the Environment and other sources, offer **methodological support** to schools. For example, the Veronica Environmental Institute (2025) offers consultancy and awards schools with the “**Exemplary School Garden**” plaque. Meanwhile, the LIPKA school facility **certifies school and natural gardens, organises workshops for teachers, and is developing the field of “garden pedagogy”** (LIPKA, 2024). Since 2019, the Ministry of the Environment has supported the construction and modification of natural gardens and classrooms at all levels of school education, through a total of CZK 350 million in funding.

FIGURE 4. URBAN GREEN SPACE WITHIN 300M OF EDUCATIONAL FACILITIES PER CITY



Source: European Climate and Health Observatory, 2024.

School gardens also perform a significant pedagogical function in the teaching practices of primary and secondary schools in Croatia. In primary schools, they are used for teaching the subject of nature and society; in secondary schools, in the subjects of agriculture and economics. **There is a long tradition of school gardens in Croatia**, but, unlike in Czechia, there is no guidance or legal framework to define the concept of school gardens or to prescribe the requirement to have one. In 1995, the project “**Most Beautiful School Gardens in the Republic of Croatia**” was introduced by two ministries and the Fund for Environmental Protection and Energy Efficiency, as well as numerous donors. Each year, a competition is organised for the title of the most beautiful school garden. The project promotes exclusively organic agriculture, the cultivation of original and native plants, the recognition of the beauty of one’s own landscape, and a return to traditional gardens in all areas of Croatia (Ministry of Science and Youth, 2024).

Meanwhile, Estonia is specifically working to reduce the number of asphalt car parks, creating bicycle and pedestrian paths to schools, and building bicycle parks and outdoor learning infrastructure. The design of schoolyards has focused on **openness to the community and urban space, integration with the landscape, flexibility and versatility, site-specificity and year-round use, accessibility and suitability for different age groups, playfulness and the encouragement of physical activity**, and

the schoolyards have been planned accordingly (EKA, 2024). On the basis of this, the initiative “Schools in Motion” has begun to promote a whole-school approach that creates opportunities for physical activities throughout the school day, including breaks, classes, physical education lessons, extra-curricular activities, school events and teacher activities. More than half of Estonian students (184 schools) now study in a “Schools in Motion” institution. This has changed the country’s school culture towards refocusing on outdoor and project-based learning, and on active and inclusive teaching methods.

Luxembourg’s Ministry of the Environment, Climate and Sustainable Development has initiated a call for projects entitled “More nature in our school yards”, to replace paved school grounds with green spaces, and to encourage the planting of trees and bushes to support the development of biodiversity and quality of life for learners. This initiative is part of the Ministry’s broader aims to support municipalities in **fighting extreme climate situations linked to drought and floodings**. Proposals need to demonstrate an active **participatory approach by learners, teachers and parents’ associations** for the project to be accepted (Ministère de l’Environnement, du Climat et de la Biodiversité, 2023). A similar example of offering financing opportunities is found in Cyprus, which runs the “**Greening the school – Greening the community**” policy, funded with EUR 300,000 annually.

The number of green spaces in schools has grown steadily in **Hungary**. According to most recent data from 2018, out of almost 6,000 public education institutions, 17 % have their own gardens (Iskolakertekért Alapítvány, 2025). One reason for this is the Hungarian **National School Garden Development Programme**, which promotes school gardens as educational spaces for hands-on learning about agriculture, biodiversity and sustainable practices. This programme was launched in 2019, with the support of the Ministry of Agriculture. Aside from the support offered by the network (newsletters, network-wide meetings, regional workshops, projects, support for developing school gardens), the programme provides necessary tools, specialist knowledge and consultancy on developing gardens. However, schools themselves must already have the space needed to develop a garden.

4.2.6. Guidelines for schools

Guidelines for schools on their journey to become more sustainable are one of the strongest policy support approaches found during the mapping task. These guidelines vary from all-encompassing guides that may include practical templates for schools to engage their community in drafting action plans, questionnaires and even calendars for the school year, to highly specific and more technical guidelines that relate to narrower areas of school sustainability, such as energy efficiency or sustainable food consumption. Below, we discuss some interesting examples and what the guidelines in question entail.

One extremely detailed example of school guidelines comes from Ireland, where the government offers a **Sustainability Toolkit for Schools**. The toolkit comprises three elements: 1) a Sustainability Self-Assessment tool; 2) a Sustainability Guidelines document; and 3) a Sustainability Policy Statement template (Department of Education, 2023a; Department of Education, 2018). Student engagement is key to the process – it is recommended that **the self-assessment is a whole-school activity involving students as well as teaching and non-teaching staff**. The toolkit also includes a social sustainability section that aims to promote **well-being by understanding what people need from the places where they live and work**. The Sustainability Guidelines provide schools with detailed information about learning for sustainability terminology, resources, programmes and ideas for action. Schools need to adhere to the School Sector Climate Action Mandate, under which they are required to adopt a **Sustainability Policy**

Statement. A template for this is provided, and serves as inspiration for the whole school community to draft the policy together.

At municipal level, a project coordinated by the Helsinki Metropolitan Region Recycling Centre in Finland provides a concise and practical guidebook to support **schools' efforts to embed the sustainable development goals (SDGs) into their everyday life** (Luomi et al., 2010). The guidebook includes practical examples covering the many aspects of daily school life into which the SDGs can be meaningfully embedded in the actions of the school community. The guidebook also provides a checklist to help lay down concrete and yearly goals, to divide the responsibility within the school regarding their promotion and follow-up. It also includes an evaluation for each of **the nine dimensions of the programme**: Saving energy, Saving water and waste, Recycling, Sustainable consumption, Sustainable food provision (all students receive a warm meal in Finnish schools), Surrounding neighbourhood, Cultural heritage and multiculturalism, Safety, and Community spirit. The guide further includes examples of school plans and questionnaires to map students' views on sustainable action in their school.

Some Member States provide **technical manuals** for schools that focus on energy efficiency and school facilities. In Belgium, the Flemish government page offers guides for schools on **sustainable facilities management**, as well as a separate guide on "Working with **'quick wins' as leverage for energy investments** in school buildings". Such tailored guidelines – especially those that take a 'quick win' approach – are particularly useful to those schools that are at the beginning of their sustainability journey. To assist schools during the energy crisis, the Slovakian government prepared an **Energy Saving Manual** as well as a practical questions and answers document on energy efficiency, which proposes organisational, technical-operational and investment measures (The Ministry of Education, Science, Research and Sport of the Slovak Republic, 2023).

Construção Publica, a Portuguese public company that is tasked with monitoring the performance of school facilities, has regularly published and updated its **architectural manuals for schools** (with editions in 2007, 2009, 2013 and 2017). All of these exhibit a strategic concern with the **flexibility of spaces, openness to the community, the quality and durability of the materials** used, and a growing concern with the **energy efficiency and environmental sustainability** of the projects. As an example, in architectural projects for schools, the guidelines require the construction of a **pedagogical garden**. The most recent publication highlighted the obligation for the building design to allow for the future installation of photovoltaic panels without complex interventions.

Slovenia's **Guidelines for nutrition in educational institutions**, while not focused on learning spaces directly, place a strong emphasis on sustainable development. They set various objectives to ensure sustainable food handling, including the management of the school's food waste, as well as local growing – all with the aim of improving the quality of nutrition, reducing environmental impact and promoting the use of sustainable resources (Zavod Republike Slovenije za šolstvo, 2024).

4.2.7. Networks, certification and awards for sustainable schools

Overall, most Member States are part of the international network of the **Eco-Schools programme**. More often than not, this is the only actor to designate schools as "green" or to provide peer-learning opportunities. However, there are a few cases in which networks and certifications have been initiated and supported by **a national or local public institution**.

In 2023, Romania adopted a new law on pre-university education. One section of it introduces the **Green Schools Network**, which aligns with the European and national

agendas for the green and smart transitions and the development of the European Education Area. The network has a comprehensive **methodology for establishing and operating “green schools”** (Ministry of Education, 2022). The Ministry of Education oversees the selection process, monitoring and support mechanisms for educational institutions aspiring to attain this status.

To encourage the visibility and uptake of sustainability, the OKKA Foundation, funded by the Finnish Ministry of Education and Culture, publishes a list of those schools that have been **awarded an environmental or sustainable development certificate** (*Oppilaitosten kestävän kehityksen sertifiointi*).

A highly developed system of networks and awards can be found in Spain. The “*Red estatal de redes de escuelas sostenibles*” (ESenRED), is a **national network of sustainable schools** created by an initiative of the central and regional education authorities in collaboration with the National Centre for Environmental Education. It aims to facilitate the exchange, collaboration and dissemination of resources and actions, as well as to promote reflection, evaluation and innovation in teaching, and to develop the competences of students and teachers. In addition, many autonomous communities in Spain have set up units of expertise led by coordinators. In the case of Catalonia, the **Catalan Network of Schools for Sustainability** has been in place since 2009, promoting learning for sustainability for schools working on environmental education programmes (XESC, 2020).

Moreover, in Spain, both **national and regional certificates and even city labels or awards** are issued to promote learning for sustainability. At national level, there is a well-documented **collection of good practices in education for sustainable development** (Ministerio de Educación, Formación Profesional y Deportes, n.d.). In Catalonia, schools can win the annual “**Green School Award**”; in Castilla y León, schools can obtain the “**Sustainable School Label**”. Madrid awards a “**Sustainable School Diploma**”; the Illes Balears, an “**Eco-environmental School Label**”; Aragón, a “**Sustainable Development Objectives School Label**”; and País Vasco, a “**Sustainable School Certificate**”.

In Lithuania, “**Darni mokykla**” (“Sustainable school”) is the name of a **network for sustainable schools** initiated by the Children and Youth Centre, a public institution of Vilnius municipality (Vilnius, 2022). The project aims to mobilise school communities to achieve the objectives of the UN 2030 Agenda for Sustainable Development and to integrate sustainable development education into all areas of school life, including governance, teaching and learning processes, curriculum planning, staff capacity-building, and day-to-day activities (Capital Children and Youth Centre, 2023).

4.2.8. Training and guidelines for educators and school administrations

There were **very few specific examples** found of training opportunities for educators to learn how to employ sustainable learning environments in their teaching. Although it can be assumed that teacher education programmes that rely on the whole-school approach would also include elements of how to teach in and with the environment (whether natural or built), the present study identified only a couple of instances in which this was specified more explicitly. For example, Spain has regulations and schemes for in-service training on sustainability education for primary and secondary teachers, which (among other things) include: innovative and engaging methods for delivering sustainability education (**including outdoor learning and learning by doing**); cross-curricular and **interdisciplinary teaching** of sustainability; and the **development of partnerships** to connect learners with the **natural world**, their local and global community.

In Italy, in line with the provisions of the National Strategy for Sustainable Development, regions and metropolitan cities are carrying out actions to build a **culture of sustainability**. These often involve schools in proposing “learning environments”, which include both material and educational actions, including teacher training. The documents relating to current projects emphasise the promotion of “educating communities”, **using both schools and other public spaces** towards sustainable education.

In **Cyprus**, guidelines are in place for teachers and other school staff to optimise green learning environments and enhance learners’ sustainability competences. The “Position Paper for the revised National Strategy for Education for Sustainable Development and Green Transition 2030” states that professional development programmes for educators, principals and education officers are being revised to include content, teaching and methodology related to sustainable development and the green transition. This includes continuous teacher education, as well as ongoing professional development programmes focusing on sustainability competences. These guidelines also differentiate between primary and secondary education levels, and are highlighted and practically applied through the teacher professional development courses on ESD (MEPAA, 2024).

With regard to **school administrators**, quite a few guidelines are available for schools to move towards sustainable learning environments, which are discussed in the subsection above. However, like teacher training, there are very few examples of training offered to school staff other than teachers. However, one such example can be found in Denmark. Copenhagen Municipality’s Department for Sustainable Development (*Afdelingen for Bæredygtig Udvikling ABU*) is a peer-learning initiative and knowledge centre specialising in sustainability education for children and youth that works to motivate change towards sustainable learning environments. It provides **professional support** on sustainability education to schools, government structures and public institutions. Interested schools can easily sign up for dedicated one-to-one training sessions with the centre’s experts, as well as registering for training sessions for their teachers on these subjects. In collaboration with the municipality and private sector, primary and early secondary school classes can also register at the centre’s website for school field visits and experimental courses on energy and water production and supply, climate change, and climate adaptation (Afdelingen for Bæredygtig Udvikling, n.d.)

4.2.9. Outdoor learning and other infrastructure for learning for sustainability

Several Member States provide policy support for learning outdoors or in places that are outside the school campus, thus enriching the student learning experience through opportunities that may not be readily available on campus, while simultaneously encouraging community engagement and hands-on experiential learning.

One especially innovative effort is found in France, where the Office Français de la Biodiversité (OFB) established **1,000 educational terrestrial or maritime areas**. These areas are small natural territories **managed collaboratively by students** throughout the school year, located near their schools. Under the guidance of their teachers and environmental education professionals, students participate in councils where they make decisions about their educational area, engaging directly with environmental issues and learning about nature conservation. The Ministry of Education aims to significantly expand this initiative by creating **18,000 educational areas** by 2030. These areas are not just concerned with environmental responsibility, but also about foster strong interdisciplinary learning and promote citizenship among students.

In Ireland, **outdoor learning** through play and exploration is encouraged by the National Council for Curriculum and Assessment, which has developed webinars to support educators in this (ETBI, 2025; NCCA, 2025).

Although not a state-run programme, **the Danish Outdoors Council** (*Friluftsrådets*) is a key actor in promoting and supporting outdoor education for learning for sustainability. It is an umbrella organisation representing more than 80 Danish civil society organisations with a shared interest in environmental protection. Among its numerous goals, it seeks to incentivise school personnel and leaders to create more sustainable learning spaces. The Council prepares resources and guidelines for schools seeking to increase the use of outdoor learning in their curriculum. This also includes targeted advice on where to apply for funding to implement extra activities (*Friluftsrådet*). The council also shares best practices observed across primary and summer extra-curricular schools. Run using municipal funding, the pilot “gardens to stomachs” project (*Haver til Maver*) brought kitchen gardens to primary-grade students, enabling them to learn about eating habits and promote a **“farm to fork” mindset** in children (ibid.).

In Finland, the National Core Curricula mentions **utilising nature and the built environment other than the spaces of the school** in the instruction of the various subjects, including a reference to the national **Nature Centres** established and maintained by the Finnish Forest and Park Service. Sweden’s approach is similar to those of both Finland and the Denmark, with schools working closely together with local municipalities, nature associations, local businesses, partners and other representative groups to improve outdoor learning opportunities on the school grounds and beyond.

Another project that promotes education outside the school campus is the **“Vilnius is a School” project**, run by the Vilnius Municipality in Lithuania. This project aims **to move at least 10 % of lessons out of the school building and into urban spaces** – museums, public institutions, parks, and so on. **It introduces a blended learning model**: encouraging schools to make creative use of places around the city and to combine traditional classroom lessons with urban learning (EDU Vilnius, 2023). The initiative not only encourages schools to organise classes outside of school buildings, but also provides **class content, materials and structure on various sustainability-related topics**. These offerings are adapted to students’ ages, and focus on topics such as environmental protection, recycling and pollution. A very similar initiative supported by the NEB comes from Latvia – the **outdoor classroom at Pluriversitāte** (Pluriversity) (Zībārte & Jakovļeva, 2023). Pluriversity is a non-formal learning initiative that approaches **the city as a learning environment**, and dissolves the classroom into the city.

Another interesting example comes from the Czech State Programme for Environmental Education, Training and Awareness for 2016-2025, which explicitly mentions supporting infrastructure aimed at learning for sustainability, namely the **network of environmental education centres**. This network is continuously maintained, updated and supplemented according to evolving educational needs. Among various types of spaces, it includes **specialised land, educational and advisory centres, camping bases, gardens, urban and suburban parks, interpretive exhibits, and trails**. The ambition of the programme is to help these centres model the principles of eco-friendly operations, thereby allowing students from schools that have deficiencies in this regard to engage with them.

4.2.10. Training, guidance, networks and peer-learning for architects and builders

Few examples were found of official and specific guidelines for architects, builders and designers on how to design educational infrastructure in line with sustainable building and design practices – although some of the more technical guidelines for schools presented above do serve that function. A few examples were found of fragmented initiatives that try to move in this direction, although they are generally only broadly related to sustainable construction rather than directly addressing the sustainability of school infrastructure.

For example, the Flemish government initiative “**Building sustainable construction education together**” (MOS) strives to develop an offering of sustainability-focused courses within the study subject of construction. Many currently available course materials on sustainability are highly technical; therefore, this initiative starts from the proposition that the profiles of the future in the construction field require both technical as well as sustainability competences such as systems thinking, critical thinking, investigative learning, future thinking, dealing with emotions and others. The initiative’s goal is to develop teaching materials, a methodology, a training course, a learning network, learning path, and so on.

In Slovakia, there is **rising interest in school buildings among architects**, with the media highlighting the tension between tenders that ask for the lowest price versus prioritising the “best solution” in terms of design and functionality. One Slovakian construction company, Sto Slovensko, has developed a methodological guide on the sustainability of building solutions. **Guide to Planning Buildings for Education** (Sto Slovensko, 2025) provides practical solutions for different functional zones, considering key factors such as acoustic comfort, hygiene and the cleanliness of surfaces, sustainability, temperature and energy efficiency, and air quality. It aims to inspire builders and investors to create learning environments that stimulate physical and mental health, while also adhering to reasonable economic requirements in terms of construction, operation and maintenance.

Another guide was developed by the Danish Technological Institute (DTI) and ABC Engineers, and published by the Social and Housing Agency in 2023. This provides examples of good practice from the Danish construction industry in the use of recycling building materials in new constructions. This includes the case of the Katrinedals school and Svanen kindergarten – both educational institutions that have benefitted from a strong internal interest in the use of recycled building materials for renovation.

In cases where state sponsored guidance is not available, the need for knowledge-sharing and peer-learning may be met through **sustainable building and construction networks**. In Germany, the German Sustainable Building Council provides a platform for architects, builders and designers to collaborate and exchange knowledge (DGNB, 2025). It holds regular seminars, workshops and conferences on sustainable building practices, and offers open access to various information that can be used for designing sustainable learning spaces. In a similar vein, the **Slovak Green Building Council** (*Slovenská rada pre zelené budovy*) advocates for sustainable construction practices in Slovakia (SKGBC, 2025). Established in 2010, this body has grown into a renowned entity with an international network. The Council fosters knowledge exchange and collaboration among professionals in the construction industry. In addition, its partnership with the Institute of the Slovak Chamber of Architects facilitates seminars on school buildings, addressing key topics such as the role of architects in renovation projects and the quality of indoor environments in educational settings.

In terms of cooperation at regional level, the **Nordic countries** have joined hands in an effort to harmonise Nordic building regulations regarding climate emissions. This has been carried out through an action plan with approximately EUR 7.5 million in funding from the Nordic Council of Ministers and Nordic innovation, and is implemented through multiple work packages and by the respective countries’ ministries (Nordic Sustainable Construction, 2025). As part of this collaborative exchange mechanism, the Nordic Sustainable Construction programme facilitated the development of teaching materials for courses specifically on the reuse of building materials in Nordic vocational schools (called “Skills4Reuse”). This course introduces students, as the future engineers and architects of their respective countries, to topics on sustainability in the construction industry, potential for the reuse of materials, legislation, and structural design issues. In the long-term, such

forums could help to not only embed sustainability into the national vocational education and training (VET) curriculum, but also involve a variety of stakeholder groups in deliberations on what constitute sustainable buildings in the Nordic context.

5. Conclusions

5.1. The potential of learning environments for sustainability

Environmentally sustainable school buildings have the potential to play a vital role in achieving Europe's climate objectives, while also addressing broader sustainability challenges. As prominent examples of public infrastructure, schools can lead by example – demonstrating the value of sustainable practices in the built environment. The design and renovation of physical learning environments can contribute to climate resilience through the integration of green infrastructure solutions such as carbon capture features and air quality improvements, that benefit both the environment and the health and well-being of the school community. In addition, energy-efficient renovations can generate long-term cost savings and improved financial efficiency, allowing schools to then channel resources towards enhancing the quality of learning. Crucially, when sustainability is embedded holistically across school infrastructure, operations and pedagogical practices, the school becomes a space for a meaningful, hands-on experience of living sustainability, rather than learning about it as a theoretical or abstract concept.

Well-being and sustainability are deeply interconnected. Schools that are designed with green spaces and nature-based solutions contribute to the physical and mental health of their students, and foster their everyday resilience and sense of connection to the natural world. Research finds that contact with nature improves cognitive function, reduces anxiety, and enhances attention. When schools are designed as healthy and stimulating spaces – particularly when they are co-created with students – they encourage a mindset of care, stewardship and shared responsibility for the environment and a sustainable future, in which individual, community and planetary well-being are considered collectively.

Happy, focused and healthy students in high-quality learning environments tend to have stronger academic outcomes and sustainability competences. Schools that ensure access to fresh air, natural light and flexible, adaptable spaces – all tailored to the local climate and cultural setting – offer conditions that are more conducive to effective learning. Embracing individualisation, stimulation and innovation while ensuring equity, inclusion and accessibility in the school's design is shown to positively influence student engagement and learning outcomes.

However, improving the environmental and health-enhancing features of a learning environment alone is not enough. To maximise their impact, these environments must be coupled with active, participatory teaching and learning approaches. Innovative pedagogies, hands-on activities and cross-disciplinary learning are essential to equip students with the knowledge, critical thinking and agency required to drive sustainable change. When sustainability is embedded across a school's physical infrastructure, educational practices and governance structures, learners are better prepared to lead sustainable transformations in their communities and beyond.

5.2. Drivers and challenges at institutional level

This study has highlighted a range of institutional drivers and challenges that affect and shape the development and implementation of sustainable learning environments. The table below summarises the key factors identified through the literature review, case studies and national-level research:

Drivers	Challenges
<p>Financial efficiency and long-term savings: renovating schools for sustainability offers major opportunities for cost savings through reduced energy and maintenance expenses, smarter water management, and potential revenue from renewable energy initiatives.</p>	<p>Lack of awareness and capacity: insufficient knowledge about funding opportunities and limited professional expertise hinder the effective adoption and integration of sustainable infrastructures and practices.</p>
<p>Student and staff agency: participatory approaches involving students, educators and staff foster a culture of ownership, engagement and co-creation, embedding sustainability as a living part of school life.</p>	<p>Stakeholder resistance and implementation burden: resistance from educators, parents and local authorities – often driven by a lack of consultation and planning support – complicates efforts to create sustainable learning environments.</p>
<p>Community integration and co-ownership: schools that open their grounds to the broader community (e.g. shared gardens, open outdoor learning spaces) strengthen social capital, create wider sustainability impact, and tap into local expertise.</p>	<p>Eco-anxiety and emotional overload: placing excessive focus on climate crises without providing sufficient emotional support tools risks increasing eco-anxiety among students. Learning environments must support agency and resilience, not just highlight environmental threats.</p>
<p>Whole-school approach to sustainability: schools that align infrastructure improvements with pedagogical innovation, teacher development, student participation and school governance (i.e. the “whole-school approach”) achieve deeper and more lasting sustainability transformations.</p>	<p>Disconnect between infrastructure and pedagogy: despite infrastructural advances, schools frequently fail to translate sustainability features into active teaching practices, largely due to skill gaps and funding limitations.</p>
<p>Multi-level collaboration: cooperation between schools, local governments, NGOs, architects, universities and businesses enhances technical capacity, financing options and innovation in sustainable school design</p>	<p>Complex funding procedures: bureaucratic hurdles and administrative burdens in accessing funding discourage school-led initiatives and limit the ability of schools to innovate sustainably.</p>

5.3. Supportive action at school and policy levels

Based on examples of good practice from EU Member States, the table below offers a round-up of policy recommendations for school leaders and national authorities, aimed at helping schools to transform their learning environments and maximise their positive impact on sustainability, as well as on learners’ health, well-being and educational outcomes. The following recommendations build on the key drivers and address the challenges identified above.

Area of concern	Conclusion	Recommendation
<p>Understanding learning environments for sustainability</p>	<p>The present study finds that there is often a lack of understanding of learning environments for sustainability. Often, infrastructure innovations for sustainability are isolated from teaching and learning processes, with limited student involvement. Usually, when schools innovate to make the school more sustainable, learners are not involved in the process, and the spaces are not used actively in teaching, either during the design and development process or afterwards.</p> <p>However, participatory decision-making that involves students, educators and school staff helps to integrate sustainable practices into the school culture and to co-create sustainability initiatives tailored to the school's unique needs and surroundings. Such actions can enhance student ownership of the school environment and improve their engagement and concentration. A proactive, open school culture helps to embed these efforts into long-term, structural change.</p>	<p>School leadership can make a more substantial effort to involve students and teachers in designing, creating/changing and monitoring learning spaces and focusing on how these spaces can benefit learning and sustainability.</p> <p>Policymakers can integrate an explicit vision and policy goals for learning environments for sustainability within national and regional education policies, and establish this as a school's foundational principle. EU policy frameworks such as the Council Recommendation on Learning for the Green Transition and Sustainable Development provide conceptual guidance, and can also promote policy cohesion at the international level. Policymakers should build on these and create whole-school sustainability and well-being frameworks that integrate building design, teaching, operations and governance. Developing multi-level and interdisciplinary taskforces (education, environment, health ministries) to coordinate policies and funding streams for sustainable learning environments may be beneficial.</p>
<p>Regulatory incentives for sustainable schools</p>	<p>Currently, the school regulations and frameworks in EU Member States do not provide strong incentives for schools to adapt according to sustainability goals, well-being and learning.</p> <p>Where they do exist, regulations focus more on energy efficiency than on holistic well-being, inclusiveness and preparedness.</p>	<p>Policymakers working on national requirements and regulations for schools could consider a range of approaches:</p> <ul style="list-style-type: none"> - energy performance requirements for both construction and renovation projects; - a requirement for all new school buildings to conform to a near-zero energy standard; - aligning energy performance with student health, safety and inclusive learning objectives; - requirements for all retrofitting projects to include climate adaptation components such as shading, green roofs and passive cooling, especially in warmer regions; - requirements for accessibility and adaptability to ensure school buildings serve diverse student populations and changing needs; - regulations for renovation policies that address the health risks of pollutants such as radon and asbestos,

Area of concern	Conclusion	Recommendation
Monitoring progress	<p>Monitoring progress towards sustainability and learning in schools can be a rewarding and motivating learning journey for all parties involved. Students can learn STEM and digital skills through this process.</p> <p>Public databases on the energy performance of school buildings enable evidence-based policy, helping to prioritise renovations, track progress towards climate goals, and improve accountability and transparency. They also support access to funding, long-term planning and knowledge sharing.</p>	<p>and set air quality standards including ventilation and safety protocols; - embedding well-being, inclusion, flexibility, adaptability, place-specific design and sustainability values into spatial and architectural planning to create future-ready learning environments.</p> <p>School leadership can ensure that accessible monitoring systems are put in place in schools (e.g. digital tools for tracking indoor climate quality and food waste, energy dashboards) that teachers and students can use for learning (e.g. they can be integrated into cross-curricular activities (e.g. STEM, citizenship education). School leadership can include indicators from this monitoring in their overarching education quality monitoring systems.</p> <p>Policymakers can include learning environments for sustainability in their overarching education and infrastructure monitoring systems. Comprehensive and transparent reporting can be achieved through digital monitoring systems supported by EU cohesion funds.</p>
Financial efficiency and funding	<p>Funding mechanisms often involve complex bureaucratic procedures, including lengthy applications and strict eligibility criteria. Schools often struggle with the high administrative burden of applying, as they lack the capacity to fulfil requirements or the budget to hire someone to assist with the process.</p> <p>The renovation of school buildings demonstrates significant potential for cost savings and improved financial efficiency. The financial rewards for doing so can stem from cuts in electricity use, gains from switching to renewables, more efficient heating/cooling systems, and reduced maintenance costs. Additional savings may come from water-efficient infrastructure and more intelligent energy management systems. In some cases, schools can also benefit from selling excess renewable energy back to the grid, or accessing government incentives for sustainable upgrades.</p>	<p>School leadership, when planning how to use the school's resources, could consider the full costs and benefits from a longer-term perspective, given that interventions may be costly up front but result in financial savings in the long run.</p> <p>Policymakers can make public funding for renovations conditional on meeting minimum energy efficiency and sustainability standards. They can consider separate streams for small-scale funding and financing that goes beyond the "technological" aspect of sustainability and can support a whole-school approach. Applications for such funding could include criteria for a participatory approach that includes learners, teachers and parents in the project planning process.</p> <p>Other funding-related considerations that policymakers can take into account: - Financial incentives must be sufficient to cover the high initial costs associated with sustainable building practices, to avoid creating a financial gap that</p>

Area of concern	Conclusion	Recommendation
		<p>deters implementation or leads to the inability to maintain the buildings.</p> <ul style="list-style-type: none"> - Debt-for-environment swap transactions – agreements to reduce debt burden in exchange for a commitment to invest in sustainability projects – can financially supplement funding schemes. - Providing funding through a dedicated institution that provides technical support can facilitate access to targeted grants and loans for school-level actors', as well as providing know-how. - The development of local energy communities based on school infrastructure could be supported through upfront capital grants and by simplifying the administrative procedures needed for permissions and grid connection.
<p>Teacher readiness and pedagogical use</p>	<p>While schools have made significant progress in adopting sustainable infrastructure (green roofs, energy-efficient buildings, green spaces), the potential for these to be incorporated into learning and pedagogical practices remains largely untapped, due to a lack of know-how and skills gap on the part of school staff, as well as limited funding to develop such competences. For instance, reports on the Masterplan initiative in Flanders confirm that 60 % of schools that installed rainwater systems rarely leverage them to advance sustainability competences (AGION, 2019).</p> <p>One notable challenge is the lack of awareness among school administrators and educators regarding available funding opportunities for creating sustainable learning environments. Insufficient expertise and training can also limit their capacity to effectively implement and maintain sustainable practices, new technologies, green building solutions and digital infrastructure in the long term.</p>	<p>School leadership can encourage teachers and the school community to use the learning environment for innovative teaching by adapting an open school approach (inviting the community to use the school grounds after school hours) and a whole-school approach that focuses strongly on improving innovative teaching practices.</p> <p>Policymakers can ensure that schools and architects receive technical support – for example, by developing guidelines on how to design, implement, manage, maintain and use sustainable school facilities (e.g. architectural guidelines, energy-saving manuals, instructions on developing pedagogical gardens, etc.). Highly localised and practical guidelines could be created through partnerships between the government, NGOs and public service institutions and companies, such as energy service companies, public construction, waste management and recycling services.</p> <p>To equip educators with the skills needed to employ learning spaces in teaching, national curricula for initial teacher education and continuing professional development must include elements of outdoor and experiential learning, cross-curricular learning for sustainability, and community-based sustainability projects.</p>

Area of concern	Conclusion	Recommendation
Collaborations and partnerships	<p>Engaging parent associations, NGOs, businesses, public entities and other stakeholders within a local setting strengthens a school's capacity to implement sustainable practices in its daily operations. Community integration and connection are vital for shaping and influencing formal and non-formal processes (through engagement with local organisations or authentic partnerships that extend learning to real-world settings).</p> <p>Resistance from stakeholders, including educators, parents and the construction industry, can also pose challenges to implementing sustainable learning environments. National mapping indicates that although teachers agree with the broader goals for sustainable learning environments, they often have concerns about a lack of detailed planning and consultation with regard to broader curriculum reforms. On a bigger scale, managing European projects can be overburdening for local governments responsible for school maintenance and adaptation.</p>	<p>School leadership can encourage strong collaboration with the community around the school, including industry and businesses, in supporting the learning environment. For instance, the school leadership can engage in green and local procurement, creating partnerships whereby as much as possible of the school's food, materials and furniture is sourced second-hand or from local green industry. School leadership and teachers can invite experts to support innovative learning and teaching in the learning spaces.</p> <p>Policymakers can support such collaborations through funding, incentives and close cooperation. For instance, local municipalities can designate a school contact person for sustainable learning environments that supports schools by getting in touch with interesting partners, organising training and learning events, and applying for funding for renovations. Policymakers could further incentivise models such as "School as a Community Hub for Sustainability" (in which schools become focal points for local climate action and lifelong learning initiatives (e.g. citizen science projects, local biodiversity hubs).</p>

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