

From Noise Reduction to Positive Soundscapes: Enhancing Well-Being in Schools

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Abstract

Noise in schools is widely recognized as having detrimental effects on cognitive performance, communication, and emotional well-being. However, schools are dynamic and vibrant environments in which sound is not merely an incidental element but a defining aspect of daily experience. This opinion paper advocates for a paradigm shift in school acoustic design from a narrow emphasis on noise control to a holistic soundscape approach that balances the reduction of negative sounds with the enhancement of positive acoustic elements. Sound should be considered a resource that actively supports well-being, engagement, and learning, rather than solely a source of disturbance. Drawing on recent research and user perspectives, several design recommendations are proposed, including the incorporation of restorative natural sounds (e.g., birdsong, rainfall), the implementation of acoustic zoning, the creation of culturally sensitive soundscapes, and the use of sound as a tool for both engagement and restoration. These strategies extend beyond classroom acoustics to address diverse school spaces, including corridors, dining halls, and outdoor areas. By integrating participatory approaches and ongoing evaluation, school environments can be transformed into soundscapes that promote comfort, connection, and resilience for both students and teachers.

Keywords: noise, positive sounds, school soundscape, school acoustics, well-being

INTRODUCTION

Noise in educational settings has long been acknowledged as a significant environmental stressor,^[1] with well-documented adverse effects on children's cognitive performance, concentration, and communication.^[2-5] These concerns have led to widespread efforts in the architectural and acoustical domains to reduce unwanted sound.^[6] While such efforts remain crucial, particularly in classrooms and spaces for concentrated learning, a sole focus on noise control risks overlooking an understanding of how sound operates within the school environment.

Schools are not laboratories of silence—they are inherently dynamic, interactive, and socially (and sonically) rich spaces. Therefore, the acoustic environment should not be evaluated only in terms of what it inhibits (e.g., distraction or discomfort), but also what it enables—such as engagement, restoration, and emotional connection. This opinion paper argues for a conceptual and practical shift in school acoustic design: from mitigating harmful noise to actively shaping positive soundscapes that support well-being and learning. This paper calls for a shift in focus:

from “less noise” to “better sound.” By adopting a soundscape approach—originally conceptualized by Schafer^[7] and later operationalized in ISO 12913-1 (2014)^[8]—schools can begin to treat sound as a resource rather than solely a problem.

A growing body of research recognizes the need for a modification from noise control to soundscape thinking. This perspective draws attention to the quality of sounds, not just their quantity.^[9] Positive soundscapes—those that include pleasant, meaningful, or calming sounds—have the potential to support well-being, focus, and social connection in schools.^[10-13] In many educational environments, voices, movement, music, nature, and silence all coexist. The aim

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should not be to suppress this diversity, but to manage it sensitively. A corridor with soft footsteps and distant laughter can feel welcoming. A reading room with quiet background music may improve focus and reduce tension. Even the sound of birdsong through an open window has been linked to stress recovery and emotional regulation.^[14]

This opinion paper asks a central question: How can schools move beyond traditional noise control to embrace soundscapes that actively support well-being and learning? The aim of this paper is to argue for a shift in perspective from viewing school sound merely as a problem to be minimized, to recognizing it as a resource that can be shaped intentionally to enhance the educational environment. By drawing on insights and emerging practices, the paper advocates for an inclusive and responsive approach to acoustic design in schools.

BEYOND SILENCE: RETHINKING THE ROLE OF SOUND IN SCHOOLS

The traditional goal of creating quiet classrooms has yielded important gains in speech intelligibility and reduced strain on both teachers and students.^[15-17] Yet, focusing exclusively on decibel levels or reverberation times can obscure the potential of sound as a positive design element. Recent research in soundscape studies has shown that sound, when thoughtfully introduced or managed, can enhance perceived comfort and even social cohesion.^[10,11,18] Moreover, the relationship between children and sound is not uniform.^[11] Age, culture, neurodiversity, and prior experiences all shape how sounds are perceived and valued.^[19-22] What may be disruptive to one student might be engaging or comforting to another. Therefore, acoustic design must address this diversity.

While noise control remains an important component of school acoustics, limiting interventions to silence and noise reduction overlooks the potential of sound to enhance the school environment. A soundscape approach moves beyond simply eliminating unwanted noise to intentionally shaping the acoustic experience in a way that supports cognitive functioning, emotional well-being, and social interaction. For instance, natural sounds such as birdsong or water can reduce stress and improve focus.^[23] Unlike silence, these sounds can provide a calming background that helps regulate emotions and encourages sustained attention.^[14,24] Furthermore, soundscape thinking allows school spaces to be acoustically adapted according to their use—supporting quiet reflection in libraries, collaboration in project rooms, and play in recreational areas.^[10] This flexibility is particularly valuable in inclusive education settings, where learners with sensory sensitivities or neurodivergent profiles benefit from predictable and supportive auditory environments. Moreover, by embedding culturally relevant or familiar sounds into the daily rhythm of school life—such as soft music, school bells, or ambient nature recordings—soundscape design can contribute to a sense of belonging and

place identity. Ultimately, the soundscape approach aligns with both biophilic and salutogenic design principles, offering not just protection from harm but active promotion of well-being, comfort, and engagement for all members of the school community.^[25]

SOUND AS A RESOURCE FOR WELL-BEING AND ENGAGEMENT

Several recent studies suggest that specific types of sound—particularly natural sounds such as birdsong, rainfall, or rustling leaves—can promote a sense of calm and mental restoration.^[11,14,24,26] These auditory elements have been associated with stress recovery, increased focus, and positive mood in both adults and children.

Incorporating natural soundscapes into school environments—whether through access to real outdoor spaces or through carefully designed indoor audio interventions—can offer moments of respite from cognitive load and social intensity. Likewise, music and culturally meaningful sounds can enhance emotional expression, foster inclusivity, and support social connection.^[27] When implemented sensitively, these sound elements can offer environments that nurture well-being.

Some may argue that implementing a soundscape approach in schools is ambitious or impractical given typical budget constraints and architectural limitations. However, many elements of soundscape design are both low-cost and adaptable. For instance, integrating natural sounds through small speakers in hallways or calming sound cues between class periods does not require infrastructure changes.^[11] Similarly, zoning spaces according to their function can be achieved through furniture arrangement, sound-absorbing materials, and behavioral cues, rather than expensive construction. In schools where physical renovation is limited, even simple interventions like using curtains, bookshelves, carpets, or wall panels can significantly improve the acoustic character of a room while supporting specific soundscape goals.^[28,29]

Moreover, the shift toward soundscape thinking does not require schools to abandon noise control; rather, it invites a more general, context-sensitive understanding of sound. Teachers and students can be actively involved in shaping their acoustic environments, for example, by selecting sound elements that promote comfort or by identifying problematic noise sources. This participatory aspect not only improves the relevance of interventions but also strengthens engagement and acceptance. While a full redesign may not be immediately feasible in all cases, incremental and affordable steps—when guided by soundscape principles—can still bring meaningful improvements to learning, well-being, and inclusivity. In this way, the soundscape approach proves not only desirable but also realistically attainable, especially when integrated into broader school well-being and design strategies.

POSITIVE SCHOOL SOUNDSCAPES

A soundscape approach to school design should incorporate both the reduction of negative acoustic impacts and the intentional addition of positive auditory experiences. The conceptual framework illustrated in Figure 1 outlines the process for a positive soundscape strategy in educational environments. Establish enabling conditions forms the foundation by creating the policy, resource, and technical infrastructure necessary for interventions. Categorizing and understanding needs centers on identifying and prioritizing school-specific requirements. This step integrates well-being and emotional support considerations, pedagogical and spatial design parameters, and participatory processes to ensure that interventions respond to lived experiences

rather than generic assumptions. Defining and adapting core strategies translates these needs into actionable design and management measures. Implement, Monitor, and Evolve emphasizes that positive soundscape design is not a one-off intervention but a continuous cycle of application, evaluation, and refinement. Feedback loops allow for ongoing calibration in response to environmental changes, community needs, and emerging research.

DESIGN STRATEGIES

The conceptual framework in Figure 2 maps eight key school soundscape design factors—Restorative Sounds, Acoustic Zoning, Sensitive Soundscape, Sound for Engagement, Outdoor Spaces, Participatory Design, Resilient Acoustic

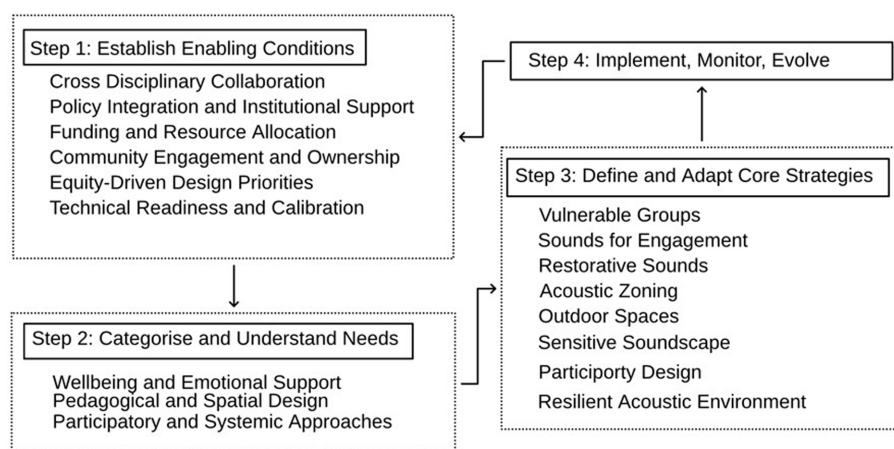


Figure 1: Process for positive soundscape strategy in schools.

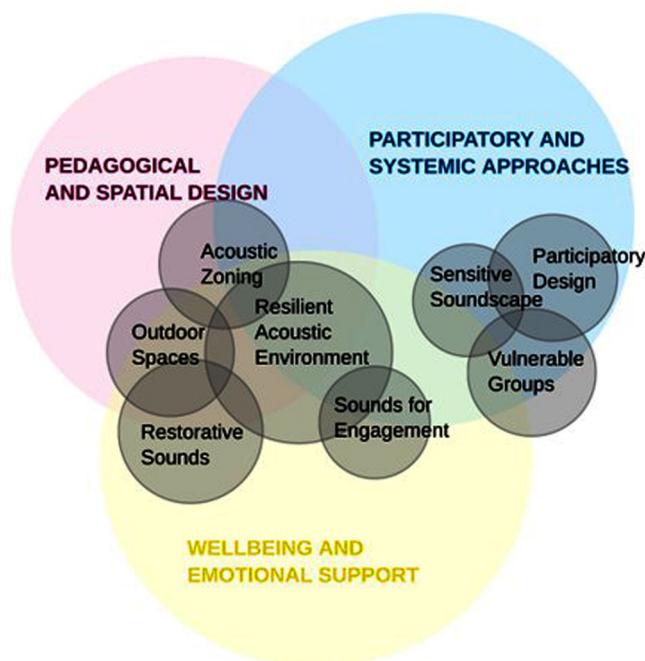


Figure 2: Soundscape design factors and their relations and importances.

Environments, and Vulnerable Groups—across three thematic domains: Pedagogical and Spatial Design, Participatory and Systemic Approaches, and Well-being and Emotional Support. Each factor's placement reflects its dominant association while illustrating overlaps between domains, signaling their multi-dimensional nature in the school context. For example, Acoustic Zoning and Outdoor Spaces are rooted in Pedagogical and Spatial Design yet also contribute to students' emotional well-being and engagement. Restorative Sounds is positioned primarily within Well-being and Emotional Support, intersecting with spatial considerations that influence restorative experiences. Sensitive Soundscape, Participatory Design, and Vulnerable Groups are situated within the Participatory and Systemic Approaches domain, highlighting the need for inclusive, collaborative planning processes. At the centre, Resilient Acoustic Environments embodies the integrative goal of harmonizing these factors to create soundscapes that support learning, participation, and emotional well-being. This configuration underscores that effective school soundscape design demands a holistic strategy that interweaves spatial, systemic, and psychosocial dimensions.

Restorative Sounds

Integrating biophilic sound elements—such as gentle water features, recordings of birdsong, rustling leaves, or subtle wind—can enhance the school environment by reconnecting occupants with nature, even indoors. These natural sounds have been shown to reduce stress, improve concentration, and elevate mood, which is especially valuable in high-demand settings like schools.^[10,26,30] Strategic placement of these elements in transition spaces such as corridors, libraries, or quiet study areas can create calming acoustic buffers between more active zones. This not only aids in mental restoration but also signals shifts in the activity, helping students and staff to mentally prepare for different modes. Beyond well-being, natural sounds can promote a sensory connection to the broader environment, fostering mindfulness and a deeper sense of place within the school.

Acoustic Zoning

Effective acoustic zoning recognizes that different activities require distinct sound environments and that a “one-size-fits-all” acoustic strategy is insufficient. Schools should be designed with clearly differentiated acoustic zones—quiet zones dedicated to deep focus and individual work, vibrant zones encouraging collaboration and social interaction, and calming zones where students and staff can self-regulate. Such deliberate zoning respects the varied auditory needs within a school and supports a dynamic balance between stimulation and tranquillity.^[29] This acknowledges the diversity of learning styles and psychological states, offering tailored environments that enhance productivity and emotional well-being. Moreover, acoustic zoning

contributes to smoother transitions between activities and spaces, reducing auditory overload and supporting cognitive flexibility.

Sensitive Soundscape

Soundscapes that thoughtfully incorporate culturally meaningful sounds reflect the rich diversity of school communities. This may include familiar musical motifs, languages, chants, or ambient sounds that resonate with different cultural backgrounds represented within the student body and staff.^[31] Designing with cultural sensitivity promotes a sense of identity, inclusion, and belonging, allowing individuals to feel seen and valued. It counters the homogenization often implicit in standardized acoustic treatments by acknowledging the social and emotional importance of sound in cultural expression. Furthermore, culturally aware soundscapes can facilitate intercultural dialogue and empathy by introducing diverse acoustic experiences into shared spaces, enriching the school's social fabric and learning culture.

Vulnerable Groups

Vulnerable groups in school soundscape design refer to students and staff who may be more susceptible to the negative impacts of poor acoustic environments due to factors such as age, hearing difficulties, sensory processing differences, language barriers, or specific learning needs. These groups often experience greater challenges in speech perception, concentration, and emotional regulation when exposed to inappropriate noise levels or noninclusive soundscapes.^[32,33] Their needs should be explicitly recognized in both design decisions and policy development. Addressing the requirements of these groups may involve tailored acoustic treatments, adaptive soundscapes, and participatory processes that allow their voices to shape the design.

Sounds for Engagement

Sound can be a powerful tool to support emotional regulation and engagement, particularly for neurodivergent students who may experience sensory processing differences.^[34] Intentional use of interactive or ambient sounds can signal transitions between classes, indicate changes in routine, or provide calming auditory stimuli to aid focus and reduce anxiety. For example, gentle chimes or natural sounds might mark the start or end of activities, helping students orient themselves in time and space. Ambient soundscapes can offer a subtle layer of sensory input that stimulates without overwhelming, serving as a restorative backdrop in stressful moments.

Outdoor Spaces

Courtyards, playgrounds, gardens, and other outdoor or semioutdoor areas are integral to the overall acoustic ecology of a school but are frequently overlooked in

acoustic planning. Ensuring these spaces have favorable sound qualities—not only in terms of noise control but also sound richness—extends learning and well-being beyond the classroom walls. Outdoor acoustics affect students' ability to play, socialize, and connect with nature, which are crucial aspects of education.^[35,36] Design interventions might include natural buffers, planting strategies, or water features that mitigate unwanted noise and enhance positive experiences. Recognizing these spaces as active, meaningful parts of the learning environment fosters more seamless transitions between indoor and outdoor learning and supports varied pedagogical approaches.

Participatory Design

Sustainable and effective acoustic environments are achieved through participatory design processes that actively engage students, teachers, school staff, and even families.^[37] Schools should ensure that interventions are relevant and sensitive to lived experiences.^[38] Participation empowers users to articulate their acoustic needs and preferences. Furthermore, ongoing evaluation involving user feedback supports adaptive management of soundscapes, ensuring they evolve alongside changing needs and school cultures. This approach strengthens collaboration, positioning soundscape design as a shared responsibility and a dynamic, user-centered endeavor.

Resilient Acoustic Environments

Positive soundscapes are not merely comfort-related enhancements—they are essential components of resilience in educational settings. This is especially true for schools in noisy urban contexts or those facing limited resources where controlling unwanted noise can be challenging. In such environments, soundscape design offers practical strategies to buffer stressors and create refuges of acoustic comfort.^[39] Therefore, investing in considered soundscapes exceeds comfort and enhances educational equity and mental health promotion.

MOVING FORWARD: EMBEDDING SOUNDSCAPE PRINCIPLES INTO SCHOOL DESIGN AND POLICY

Reframing the role of sound in schools demands an interdisciplinary and participatory approach to design. Rather than aiming for silence as the ultimate goal, we should strive for soundscapes that are meaningful, supportive, and inclusive. By embracing both the challenges and opportunities of the acoustic environment, schools can become places where every sound contributes to the learning and well-being of all who occupy them.

In embracing this participatory approach to school soundscapes, we open the door to educational environments that do more than just accommodate learning. Ultimately, reimagining how schools sound is a

step toward schools that do not just teach but also nurture; not just contain noise but create soundscapes that resonate with well-being, inclusion, and a sense of belonging.

Looking forward, future research should explore long-term impacts of soundscape interventions across diverse school settings and populations, including neurodivergent learners and culturally varied communities. Additionally, advances in technology—such as adaptive sound systems and real-time acoustic monitoring—offer opportunities to personalize and optimize school soundscapes. Policymakers and educators are encouraged to consider soundscape principles in school design and refurbishment. Yet, for these developments to achieve broad and lasting impact, they must be supported by policy and design frameworks. A notable gap, identified in the international school acoustic guidelines, is the lack of explicit recommendations on soundscape design.^[40] Addressing this omission would ensure that the constructive role of sound in education is acknowledged alongside traditional noise control measures, providing educators, designers, and policymakers with clear, research-informed strategies to foster well-being, inclusion, and engagement in schools. Without this, opportunities to harness sound as a positive educational resource will remain underused, and the full potential of school environments to nurture all learners will go unrealized.

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Conflict of Interest

The author declares no conflict of interest.

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