



# Insulation solutions for education

A holistic approach to designing and specifying education buildings for positive learning environments, sustainably







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## Introduction

Good design is the foundation of healthy, sustainable and user-centred buildings. This has never been truer than in the education sector. Research shows that classroom design can influence a student's academic performance by up to 25%, both positively and negatively.<sup>1</sup> It can also impact the development of social skills, exacerbate behavioural issues, and contribute to student and teacher health and wellbeing, motivation and productivity.

Understanding exactly how a school's physical environment impacts students and teachers is critical for educators and designers. Numerous studies have linked environmental factors such as thermal comfort, indoor air quality and acoustics to health outcomes and student and teacher performance. Accordingly, improvements in these areas through considered design solutions can enhance academic performance as well as teacher and staff productivity.

Schools face tough decisions in how to allocate resources. Funds invested in new builds and renovations to improve the environmental quality of classrooms and other learning spaces is a sound one. One of the best ways to improve indoor conditions is through a high-performing building envelope, of which insulation plays a pivotal role. A well-insulated building can control noise as well as temperature, reduce energy costs through passive cooling and warming, and improve indoor air quality by effectively managing condensation.

In this whitepaper, we consider a holistic approach to designing positive learning environments that encompasses thermal comfort, indoor air quality, acoustics and sustainability. We also highlight how sustainable insulation materials – in walls and ceilings, under floors and roofs, around building services, and in and around the heating, ventilation, and air conditioning (HVAC) applications – can help designers create more comfortable places to learn, teach, and work.



## How the built environment impacts learning outcomes

Environmental factors in the classroom can significantly affect students' academic performance, health and wellbeing, with noise, air quality, and temperature among the most influential in determining the overall success of a learning environment. Where these factors are well balanced, students are motivated, engaged and their learning abilities are enhanced. In environments that are too warm, too loud or generally uncomfortable, teachers find it more difficult to communicate, and students struggle to absorb information and stay engaged.<sup>2</sup>

The effects of indoor temperature and air quality on learning outcomes was explored in an Australian field study conducted in secondary school classrooms in Sydney during 2018 and 2019. This study found that increases in indoor temperature and CO<sub>2</sub> concentration were linked to students' feelings of fatigue and decreases in their ability to concentrate.

Research suggests that an optimal learning environment is one in which students feel "slightly cool" to "cool". A survey of Australian children in 2013 found that an indoor operative temperature of about 22.5°C was found to be the students' neutral and preferred temperature.<sup>3</sup> This temperature is cooler than what is expected for adults under the same thermal conditions, suggesting that children feel more comfortable at cooler temperatures compared to adults.<sup>4</sup>

High indoor temperatures and humidity are also associated with headaches, eyes and throat irritation, allergic reactions and respiratory illnesses.<sup>5</sup> Deficiencies in indoor air quality can aggravate asthma due to the exposure to dust, pests

and mould.<sup>6</sup> These problems can not only reduce teacher and student performance, comfort and attendance, but contribute to broader community issues, including straining of relationships between parents and the school administration.

Uncontrolled noise is a growing problem in Australian classrooms, yet acoustic design is often an afterthought during the design phase. Classrooms with poor acoustics make it difficult for students to hear and understand speech, and to maintain concentration. Students who continually miss words, phrases and concepts in the classroom are significantly disadvantaged in the development of their comprehension and language skills.<sup>7</sup> High levels of noise are also linked to increased signs of stress in children, including irritation, aggressiveness, fatigue and headaches.<sup>8,9</sup>

Despite the issues with classroom noise, there is a growing trend of open-plan classrooms in Australia that feature multiple classes of children working collaboratively in groups or independently within the same space. A recent study of four Sydney schools found that children were annoyed by the noise in open-plan classrooms, with 50-70% of children surveyed saying they could not hear their teacher very well, or at all, when the other classes were doing noisy group work activities.<sup>10</sup> In addition, teachers in noisy open-plan classrooms need to elevate their voices more often than they would do so in an enclosed classroom, increasing the risk of vocal strain and other related problems.<sup>11</sup>



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## An integrated approach to education design

### Minimising unwanted noise

Poor acoustics within a classroom can often be attributed to high ambient noise levels and reverberation within the space, which impacts listening comprehension and speech intelligibility. The National Construction Code (NCC) sets out the minimum sound insulation requirements for walls and ceilings for new builds, but there is no Australia-wide standard that covers all aspects of acoustics in educational environments.<sup>12</sup>

There is some industry guidance available, one of the most useful being the Association of Australasian Acoustical Consultants (AAAC) Guideline for Educational Facilities, which deals with the following acoustic issues in education environments:

- the intrusion of external noise;
- noise generated by building services;
- noise transferred between individual spaces including impact noise; and
- control of reverberation times to enhance speech intelligibility.

To achieve a suitable learning environment, designers must meet acoustic performance criteria for background noise (which includes both external noise intrusion and sound insulation) and reverberation time. Acoustic treatments are the most effective solutions for controlling reverberation and noise transmission. Sound insulation is needed to reduce background noise, and this should be combined with sound absorbing materials to lower reverberation times.

Acoustic wall panels, partitions, soundproofing materials and ceiling baffles absorb sound and stop it from transmitting back into the room or through a partition into adjoining space. An acoustic consultant should be consulted to ensure the right products and insulation are selected and configured to achieve an ideal acoustic environment.



## Controlling indoor thermal comfort, air quality and condensation

Many Australian classrooms suffer from poor thermal conditions and indoor air quality. A variety of factors contribute to this including, Australia's harsh climate, the construction of building envelopes, reduced ventilation rates, and the use of synthetic building materials and furnishings. In a recent study, the University of New South Wales School of Built Environment found concentrations of CO<sub>2</sub> in some Australian classrooms peaked significantly higher than levels prescribed by the NCC due to a lack of proper ventilation.<sup>13</sup>

Condensation management is a contributing factor to poor indoor air quality. Condensation can form on surfaces within the building fabric that are below the dew point. Many modern buildings exacerbate condensation issues due to the focus on reducing air gaps and openings in the building envelope, which prevents water vapour from escaping. Condensation can accelerate the decay of building materials, and provide conditions for mould and mildew to grow within the building structure.

Upgrading building envelope materials is one approach to addressing these problems. There are a range of products for wall, ceiling and underfloor systems that offer excellent thermal performance and condensation management. Adding natural ventilation can help dilute polluted indoor air with cleaner outdoor air, while also providing passive cooling during warmer months. The correct selection and use of these solutions will be dependent on the specifics of the project, including geographic location, application and the overall system design.



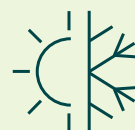
## Protecting people and buildings from fire

Compliance with the NCC's stringent fire safety requirements is non-negotiable, and goes hand-in-hand with other aspects of environmental design. A building that is designed to be firesafe uses passive fire prevention measures and fire-resistant products to protect both property and people. Non-combustible insulation installed in external and internal walls, floors, ceilings, roofs, and around HVAC applications is an integral part of a school's fire safety strategy.

It is essential designers specify insulation that is made of sustainable, non-combustible or low flammability materials. Under the NCC, specified elements of buildings of Type A or B construction, such as external and common walls (including components incorporated in them such as the facade covering, framing and insulation) must be non-combustible. Non-combustibility is assessed through the small-scale test in AS 1530.1:1994 "Methods for fire tests on building materials, components and structures, Part 1: Combustibility test for materials".



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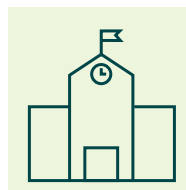
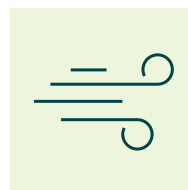




## Driving sustainable outcomes

Good insulation is an important part of creating a sustainable building design. Poor insulation means that a school will have a greater dependence on artificial heating and cooling over its lifetime, resulting in higher energy consumption, emissions and utilities bills. The right choice in insulation based on the climate and building type contributes to interior environments that are thermally comfortable all year round while using less energy and resources.

The concept of sustainability goes beyond energy efficiency. When designing school environments, it is important to avoid toxic materials and products that harm the environment or pose a risk to human health. In terms of insulation, look for products that are made with recycled materials, use sustainable and ethical production methods, promote renewable energy sources, and do not contain harmful levels of Volatile Organic Compounds (VOCs).



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# Building envelope applications

With one of Australia's widest distribution and sales coverage networks, Fletcher Insulation provides energy efficient and acoustic solutions to the residential, commercial, HVAC and industrial markets. The company manufactures and distributes a wide range of insulation products specially designed for thermal and acoustic systems.

In developing their product range for education buildings, Fletcher Insulation always takes a systems approach. The company considers a range of performance parameters including energy efficiency, thermal bridging, fire resistance, internal comfort, acoustics, moisture, air tightness, and durability. They examine how they interact and work both within the building envelope and beyond.

## Roofing

Fletcher Insulation has a comprehensive range of insulation solutions to meet the most demanding environments and performance requirements. One of the most effective insulation solutions is the Permastop® Building Blanket range, which features effective thermal and acoustic properties to reduce heat transfer and minimise the internal reverberation and flow of distracting noise, such as rain on a metal roof.

The Permastop® range also enables architects and specifiers to optimise building space. Exclusive to Fletcher Insulation, the R3.6 Permastop® Building Blanket, for example, offers the highest thermal performance for a 130mm blanket on the market. To reduce thermal bridging, we recommend using Roof Razor combined with Permastop®. Roof Razor allows full recovery of the insulation blanket between the safety wire mesh and metal cladding. By combining these products, a building designer will achieve optimum thermal performance, meeting or exceeding NCC requirements.

As demand for better condensation management increases, the properties of Permastop® building blankets help minimise condensation that can form under metal cladding.



## External walls

External wall insulation is central to managing energy efficiency, regulating thermal conditions within the building, and meeting fire performance regulations. It must also meet the varying acoustic needs of different learning spaces within the building envelope.

Fletcher Insulation's Pink® Partition range of glasswool insulation features outstanding performance capabilities. With proven non-combustibility and acoustic performance, the product also features a comprehensive range of R-values, densities and thicknesses.

Fletcher Insulation products are ODP-free in both the finished product and in the manufacturing process, and are manufactured using recycled materials whenever possible. Up to 80% of the glass used in the company's glasswool insulation production is recycled, transforming a waste product destined for landfill into an environmental defender. They also contain no harmful levels of Volatile Organic Compounds (VOCs), helping to maintain indoor air quality.





## Ceiling, partitions and services

Fletcher Insulation's Pink Partition range is ideal for all types of learning spaces. Like all Fletcher Insulation glasswool insulation products, Pink Partition is non-combustible. Not only does it protect lives, but it also helps reduce the damage should a fire break out. This also means there is less disruption to education and significantly lower costs following a fire.

Pink Partition insulation provides excellent thermal insulation properties, with R-values ranging from R1.2 to R3.5. By keeping buildings cooler in summer and warmer in winter, it helps meet the thermal comfort needs of students and teachers.

Made in Australia from up to 80% recycled content, the Pink Partition range is designed to meet AAAC recommendations – from low to high ratings. It is another example of how Fletcher Insulation provides architects and specifiers with the products they need to deliver optimum acoustic performance in all learning spaces.



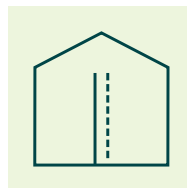
## HVAC

Fletcher Insulation's ductwork sound attenuation products complete their holistic systems approach. The thermal properties of the company's HVAC products offer both efficient temperature control and safe indoor air quality, while minimising noise when the HVAC is operating.

Non-combustible and safe to use, this HVAC range is flexible, lightweight and strong, making it ideal for specifying in schools, colleges and universities.



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