

# CRITICAL DESIGN FACTORS FOR EDUCATIONAL FACILITIES

Architectural support services & tools





Meeting learning trends in educational buildings, while complying with building codes, presents unique challenges to architects and designers

Classrooms of today bear little resemblance to those of yesteryear – and they will continue to evolve as technology plays an increasingly significant role in learning. Just as in the workplaces of the future, collaboration, interaction and fluidity have become fundamental educational strategies, demanding flexible, adaptable learning spaces. The design of future school and higher education facilities must adapt to embrace this evolution.

#### 21st Century educational facilities

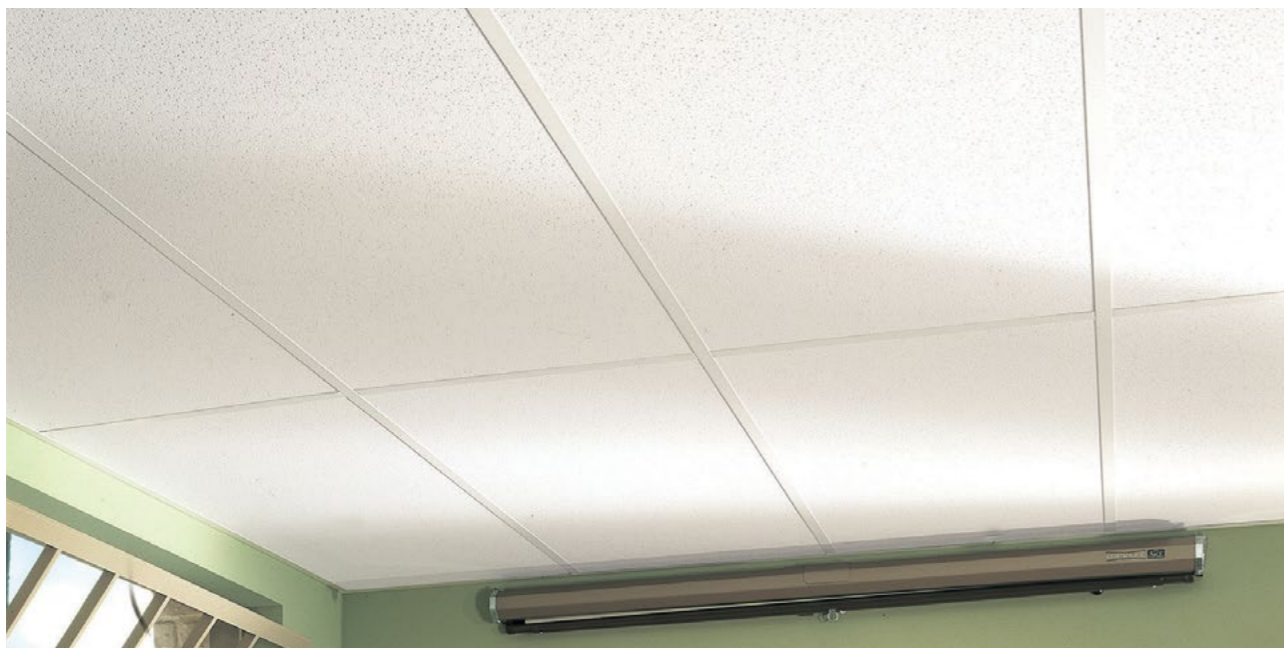
A seminal book, *The Language of School Design: Design Patterns for 21st Century Schools*,<sup>1</sup> identifies six aspects of best practice that support the requirement of contemporary educational facilities. These facilities should be effective in:

1. Supporting teaching and learning
2. Maximising physical comfort and well being
3. Demonstrating environmental responsibility
4. Serving the community
5. Establishing design principles that make buildings work better, last longer, cost less to renovate and maintain, and inspire and adapt to changing needs
6. Applying open, transparent and collaborative processes that allows the school and community assume ownership of planning and design

The design and construction of the building envelope – including floors, walls and ceilings – will play a significant role in achieving these goals. Of especial interest in the educational context are requirements for:

- Fire protection
- Quality lighting
- Acoustic performance for sound isolation and absorption
- Impact resistance
- Sustainability

Let's examine each in turn, and the ways they can be effectively addressed by architects and designers responsible for educational infrastructure.



**Fire protection**

Minimum fire rating requirements for schools and other educational buildings are set out in the National Construction Code (NCC).

The NCC contains 'deemed to satisfy' Fire Resistance Levels (FRL) for various building elements, including internal walls and shafts, external walls, load-bearing beams and columns as well as for floors and roofs.

Fire Resistance Level as defined in the NCC is the grading period expressed in minutes for three criteria: structural adequacy, integrity and insulation. These are set out in Australian Standards 1530-4-2005: Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance test of elements of construction.

Some elements – including external walls less than 1.5m from boundaries, many internal walls as well as all floors– all require the highest FRL of 120/120/120 – which means each criteria must be able to resist fire for two hours under testing.

Additional requirements can include supporting elements for fire-rated construction, columns, atriums, sprinkler systems, car parks, doors and fire isolated exits, with many variables.

For full FRL requirements for education facilities refer to the NCC.

While there are no specific acoustics provisions for educational facilities in the BCA, good acoustics are critical to the comfort of students and staff – as well as the ability to achieve effective learning and development.

**Fire Protection | How Knauf Helps**

Knauf offers a wide range of lightweight fire-rated solutions to satisfy NCC provisions for educational buildings, including fire-rated internal walls and ceiling systems up to FRL 120/120/120 – plus fire-rated external walls, shaft wall systems, and column and beam protection.

All Knauf fire-rated plasterboard systems are supported by test reports from Testing Authorities or professional opinions, as required by the NCC.

To reduce design time and effort, appropriately fire-rated plasterboard systems can be selected online via our eSelector tool or from our Systems+ plasterboard systems manual.



**Quality lighting**

A survey conducted by the New Zealand Department of Education found that, for teachers, quality of light was one of the top three most important factors in classroom design. Students rated the ability to see the board clearly the same as hearing the teacher easily. Both teachers and students prefer natural light over artificial and actively dislike fluorescent lighting due to glare and flicker.

According to an excellent set of guidelines<sup>2</sup> subsequently developed for the Department, natural daylighting should always be the main source of lighting in schools – its benefits include improved teaching and learning performance, health and well-being, better quality light and energy savings. Apart from the shape and orientation of rooms, the guidelines cite three factors:

1. The ability to see the sky from a classroom is important; influencing those without a sky view may judge the daylight as insufficient natural light and need electric light
2. Light reflected from external surfaces can form a great proportion of the light available inside a room, especially if the obstructing surface – such as another building – is light coloured
3. Internally reflected light – from ceilings, walls and floors – can help spread daylight to darker areas of rooms

This last factor indicates the desirability of using reflectant surfaces and lighter colours – to improve lighting efficiency as well as provide better daylight distribution.

**Quality lighting | How Knauf helps**

Knauf ceilings offer a range of products that efficiently reflect light within a space to enhance indirect lighting, reduce energy consumption and create a warm, luminous aesthetic.

Measured per ASTM E14771, LR value represents the percentage of light reflected from the surface of a material. The industry average for panels is LR .70 to .80, and values above LR .85 are considered high.

Knauf offers numerous panels with LR values at these levels, including MARS™ ClimaPlus™ at LR .89.

Indirect lighting, combined with high-LR panels, can eliminate dark, shadowy areas and too-bright hot spots, improving the look and feel of a space and minimising student eyestrain. High-LR ceilings can also help conserve energy and cut operating costs by achieving the same light levels with fewer fixtures and lower-wattage bulbs. Fewer fixtures also mean less repairs and lower maintenance costs.

### Acoustic performance

The ability for a student to hear and understand what is being said in the classroom is vital to their learning and development. Unfortunately, a noisy classroom can severely interfere with learning and teaching, impacting understanding, behaviour, attention, concentration and ultimately academic achievement.

Noise can also have adverse impacts on those teaching, with 80% claiming it is a major stress factor. Studies have also shown that teachers are 32 times more likely to have voice problems compared to similar occupations.

There are two elements that impact the acoustics of a space:

7. Background noise includes any sounds from outside that infiltrate another space. Voices from adjacent classrooms, footsteps in the hallway, musical instruments, traffic, playground and HVAC units are all common sources of disruptive noises that can infiltrate rooms in educational facilities.
8. Reverberation is any sound generated within a room that continues on as the sound reflects off surfaces such as desks, chairs, walls and ceilings. When sound lingers in a room there is more interference with speech, making it important to have a short reverberation time.

Reducing the impact of both background noise and reverberation through good acoustics is key. NSW Environment Protection Authority building construction methods provide a useful noise control strategy for educational facilities – major controls being building elements such as doors, walls, windows, floors, roofs and ceilings.<sup>3</sup> To combat noise and reverberation, these building elements should provide both sound isolation and sound absorption.

#### Sound isolation

The Association of Australasian Acoustical Consultants (AAAC) has recommended sound isolation criteria for educational buildings, which provides a good resource for specifying effective sound isolation solutions. AAAC criteria complements the recommendations made in AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors.

### Sound absorption

The ability for floors, ceilings and wall surfaces to absorb sound is essential to good acoustics. The sound absorption of these building elements will be reflected in its Noise Reduction Coefficient (NRC) rating. The NRC rating is an average of how absorptive a material is, expressed in a number between 0 (no absorption) to 1 (perfectly absorptive).

A ceiling with an NRC 0.50 would absorb 50% of noise.

#### Sound absorption | How Knauf Australia helps

Knauf offers an extensive range of light-weight wall and ceiling solutions to satisfy sound isolation criteria recommended for the education sector by the AAAC.

For reducing reverberation, Knauf offers a range of solutions that assist with sound absorption. Knauf Echostop® is a perforated plasterboard available in five attractive designs which can be used for both ceilings and walls to provide Noise Reduction Coefficients up to NRC 0.80.

Knauf acoustical ceiling tile systems provide Noise Reduction Coefficients up to NRC 1.00.





### Impact protection

High-traffic, high-impact educational environments can result in increased wear and tear, shortened lifespans and more frequent maintenance requirements.

Impact damage to internal wall surfaces is a major contributor to the maintenance costs of educational facilities. Corridors, gyms, sports halls and classrooms are particularly susceptible to far in excess of normal impact damage.

One Australian educational authority, the South Australian Department for Education and Child Development, has documented

recommendations for selecting materials and finishes for their ability to resist damage and low maintenance characteristics. Its design standard<sup>4</sup> specifies internal walls to be made of materials and finishes that resist damage and marking, especially up to 1200mm above floor level – for example, a 13mm high-impact resistant multi-purpose lining or similar.

Other 'impacts' on walls and ceilings to be factored into educational facilities design include water and mould resistance in areas such as scientific, domestic science and sporting facilities – including changing/showering facilities and swimming pools.

### Impact protection| How Knauf helps

Knauf's range of impact-resistant linings is ideal for educational environments, satisfying the design standards specified by the SA Department for Education and Child Development.

The Multistop™ range is a tiered system, which means you can choose from a range of multi-function plasterboard products to suit each individual project. Whether it's resisting mould, water, fire, dampening sound or providing a high impact surface, Multistop™ plasterboards allow you to tailor specific solutions and provide better value for money.

Knauf's FIBEROCK® Aqua-Tuff™ gypsum fibre board is a versatile, lightweight solution with exceptional impact resistance to hard and soft body impact such as bumps and blows common in education environments. In addition to very high impact resistance, FIBEROCK® also offers excellent mould, moisture and sound resistance.

The Asona acoustical ceiling and wall panels distributed by Knauf in Australia have a proven track record in educational facilities, including areas of extreme impact such as sporting and swimming areas.

### Sustainability

Sustainable Design is an integral requirement of many government and non-government projects. Government authorities and leading developers now commonly go beyond the minimum energy efficiency requirements of the NCC, to specify Green Star rating for educational facilities.

Attaining Green Star rating involves more than the design of an educational building to maximise natural light to minimise energy use, or the collection and use of stormwater. It involves the entire lifecycle of the building – as well as the materials used in its construction. For this reason, the selection of sustainable products has become of prime concern in educational projects.

#### Sustainability | How Knauf helps

Knauf plasterboard products are manufactured from a combination of natural gypsum, and paper liner made from 100% reclaimed and recycled paper waste. Plasterboard waste can be reclaimed and recycled into new plasterboard, or reused as a soil conditioner. FIBEROCK® Aqua-Tuff™ gypsum fibre board contains 95% recycled materials.

A number of Knauf ceiling tiles are manufactured with mineral wool made from slag, an industrial by product from steel production, recycled paper and plant-based binders. Knauf ceiling products are high in recycled content, while maintaining a high durability index or life expectancy. Recycled content for Knauf ceiling products ranges from 34% to 72%.

Customers may be eligible to receive Green Star credit points by using Knauf plasterboard and ceilings products. Those points can be received in the categories of "indoor environment quality" and "materials".

#### INDOOR ENVIRONMENT QUALITY (IEQ)

Knauf plasterboard, ceilings, compounds and adhesives have been independently tested to confirm compliance with Green Star specification limits for VOCs and are formaldehyde free.<sup>5</sup>

Compared to other providers of ceiling products, Knauf offers one of the widest selections of standard ceilings that satisfy stringent IEQ requirements and guidelines related to VOC and formaldehyde emissions. More than 20 ceiling families deliver zero- or low-VOC-emissions performance.

#### MATERIALS

Knauf plasterboard products may contribute to project Life Cycle Assessment (LCA) credits. Plasterboard Life Cycle Inventory (LCI) is available on the Building Product Innovation Council website at [bpic.asn.au](http://bpic.asn.au).

Many Knauf plasterboard and ceiling products are certified by GECA and/or Greentag.

For more information on the sustainability credentials of Knauf products and systems, please contact TecASSIST™ on 1800 811 222.



### Comprehensive design solutions for education

Today's educational institutions – primary, secondary or higher; public or private – are demanding facilities which not only meet NCC compliance, but go beyond to create innovative learning environments which express their 'brand' and inspire their communities of students, staff and parents.

Knauf offers a wide range of systems that provide a solution to the five pillars of good design in educational facilities: fire protection, quality lighting, acoustic performance, impact protection and sustainability. Our versatile wall and ceiling solutions can help guarantee safety and compliance in creating spaces that meet the higher demands of 21st century educational building design.

In addition, we offer architects and interior designers a comprehensive range of online tools and on-site architectural, engineering and technical support – reducing the time and effort involved in creating inspiring and code-compliant educational projects.

### About Knauf

Today Knauf is one of the world's leading manufacturers of modern insulation materials, drylining systems, plasters and accessories, thermal insulation composite systems, floor screed, floor systems, and construction equipment and tools.

With more than 300 production facilities and sales organisations in over 90 countries, 40,000 employees worldwide, and sales of 12.6 billion Euro, the Knauf Group is without doubt one of the big players on the market – in Europe, the USA, South America, Russia, Asia, Africa, and Australia. At Knauf, we are committed to delivering only the best to you – our customers and partners. For more information on Knauf refer to [knaufpac.com](http://knaufpac.com).



# KNAUF SERVICES



## TECHNICAL ASSISTANCE

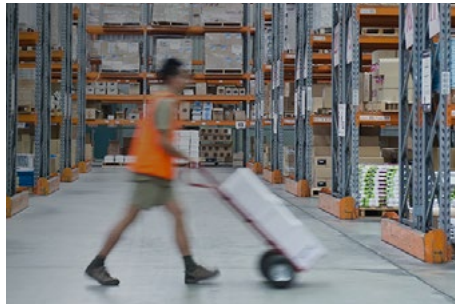
TecASSIST™ – 1800 811 222

Our National TecASSIST™ helpline is available to answer technical questions and provide free advice to builders, contractors, architects, engineers and home owners throughout Australia.

There are many variables that can influence construction projects, which affect whether a particular construction technique is appropriate. Before proceeding with any project, we recommend you obtain professional advice to ascertain the appropriate construction techniques to suit the particular circumstances of your project. We recommend you use qualified tradespersons to install this system.

The technical information contained in this manual was correct at the time of printing. Building systems, details and product availability are, however, subject to change. To ensure the information you are using is current, Knauf recommends you review the latest building information available on the Knauf website.

For further information, contact TecASSIST™ or your nearest Knauf sales office.



## WHERE TO BUY

1800 003 377

If you are wondering where to buy plasterboard and other building materials such as cornice, compounds, ceilings and plastering tools, you can be confident that wherever you are located in Australia, you will be able to find a convenient Knauf store or stockist near you using our store finder.



## DOCUMENT FINDER

[knaufapac.com/au/resources](https://knaufapac.com/au/resources)

Find a Knauf product brochure, installation manual, Product Data Sheet or Whitepaper with the new document finder tool.

See [knaufapac.com](https://knaufapac.com) for the most up-to-date product information.

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