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LEARNERS ENGAGE IN
SCHOOL DESIGN?



WITH GUEST EDITOR JONATHAN NICHOLLS: HAYHURST & CO

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Planning Learning Spaces in Practice
Newnham Mill, Newnham Road, Cambridge CB3 9EY
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projects@planninglearningspaces.com



PLANNING LEARNING SPACES

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Editorial Board Murray Hudson
Production Editor Clare Cook
Sub Editor Christopher Westthorp
Design clockstudio
For A4LE (Europe) Terry White

CONTACT:

magazine@planninglearningspaces.com

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A LISTENING ARCHITECT

JONATHAN NICHOLLS
GUEST EDITOR

At the beginning of a new commission, a funder for one of the UK's most prominent educational charities once asked us: "Are you a listening architect?" At the time, the question seemed perverse to us. However, the collaborative design relationship that followed revealed how many of the previous architects they had worked with were not.

The idea of listening is core to this edition of *Planning Learning Spaces*: listening to learners, listening to educators, and successfully processing the experiences of building users and communities into new designs that support improvements to learning. The work in this edition demonstrates that the process of design, as with education itself, is in continual evolution and one size does not fit all.

The Deaf Academy in Exmouth, which I had the privilege of visiting as part of the judging panel that gave it the Selwyn Goldsmith Award for Universal Design in 2022, helps to show the extent of progress that can be achieved in design today. The architect's approach to the commission – asking questions and listening to the expertise and experience of the school's staff and pupils – is demonstrated in the enabling spaces that have been created and the successes the school and its pupils are achieving in their new, transformative environment.

The pure joy of the Reggio School in Madrid is a bold example of how architects working collaboratively with a school community can help to shape its educational ethos. Andrés Jaque and his team's commitment to research, and an intensive consultation process, supports the Reggio Emilia method to embolden the imagination of the pupils and for them to define their own curriculum – as well as, in this case, their own unique environment. The outcome of this collaboration is a fascinating educational environment, one which will provide further research into learning spaces, and Irena Baker's article in this edition explores some of its impacts on its first users.

At its heart, MATT+FIONA's work always demonstrates that the outcome of a good design approach can be more than its physical output. Its recent Brixton House project in South London confirms that even with the challenges of lockdowns the positive impact of engaging young people in the design process provides significant positive change for those involved. MATT+FIONA's creative approach to enabling young people, and supporting them to become equipped with new knowledge, skills and behaviours, chimes closely with a report from the UK's House of Lords, the second and non-elected chamber of parliament. Published by the House of Lords' Education for 11-16 Year Olds Committee, the report makes the case for how the education system needs to change to allow young people to flourish in the future.

By listening and responding with a collaborative approach to school design we progress architecture and the achievements of educators and learners alike. Involving teachers and pupils in the design process means they have a voice in the creation of their new learning spaces and an understanding that they have a say in how their environments are created and run. Today, this voice is more important than ever.

The recent emergence of the inadequacy of many of the UK's school buildings, both historic (the identification of the extensive impact of RAAC) and new (the fiasco of the collapse of the Caledonian Modular school building), brings to the fore the need for a considered approach to school commissioning and procurement.

We need an approach that listens to the building users and local communities, the educators and the pupils, gives them a voice in the design process and provides them with developments that support their specific educational needs. ■

HOUSE OF LORDS CALLS FOR REFORM OF SECONDARY EDUCATION SYSTEM

The current education system for 11–16-year-olds is too focused on academic learning and written exams, according to a new House of Lords report, *Requires improvement: urgent change for 11–16 education*.

The report, published by the cross-party Education for 11–16 Year Olds Committee in December 2023, calls for the English Baccalaureate (EBacc) to be abandoned immediately, and warns that there are limited opportunities for pupils to study a broad and balanced curriculum and develop core skills. It also urges the government to implement wide-ranging reform to create more space for technical, digital and creative areas of study, and reduce the burden of GCSE exams.

Jo Johnson, chair of the committee, said: "The evidence we have received is compelling. Change to the education system for 11–16 year olds is urgently needed, to address an overloaded curriculum, a disproportionate exam burden and declining opportunities to study creative and technical subjects."

"Immediate and longer-term reform is essential to ensuring that our secondary system equips young people with the knowledge, skills and behaviours they need to progress to the full range of post-16 options, and to flourish in the future."

The report sets out a number of recommendations.

Reform the 11–16 curriculum by:

- Reducing the dominance of rote learning, freeing up capacity for schools and teachers to offer a more varied, richer range of learning experiences and develop a broader set of skills.
- Providing more opportunities at Key Stage 3 and 4 to study creative, cultural, vocational and technical subjects, which will open up pathways to the full range of post-16 options and nurture core talent for the future economy.
- Developing and introducing a basic digital literacy qualification and a new GCSE in applied computing.
- Giving pupils the option to take functional literacy and numeracy qualifications at Key Stage 4 which differ from, but are equal in value to, GCSE English and maths.

- Embedding opportunities for oracy and communication skills development across the Key Stage 3 and 4 curriculums.
- Embedding climate change and sustainability education across the Key Stage 3 and 4 curriculums.

Change how 14–16-year-olds are assessed by:

- Considering proposals to reduce significantly the amount of external assessment undertaken by pupils during Key Stage 4.
- Introducing a greater proportion of non-exam assessment.
- Driving the move towards introducing more on-screen assessment in GCSE exams.

Revise school performance measures by:

- Abandoning the EBacc entirely, including the ambition for 90 per cent of pupils to be taking this subject combination, and removing all references to the EBacc from Ofsted's school inspection handbook.
- Refining the progress 8 measure to ensure that schools maintain an appropriate level of focus on the core subjects of maths, English and science, while enabling them to promote a broader range of subjects to pupils at Key Stage 4. ■



RAAC FOUND IN MORE THAN 200 ENGLISH SCHOOLS



Initially, around 147 schools were named as having the presence of reinforced autoclaved aerated concrete (RAAC), like Harlowbury Primary School in Harlow (pictured). Around 231 cases of in English schools have now been confirmed by the government.

The existence of RAAC in education settings hit the headlines at the start of the 2023–2024 school year, after the government published guidance at the end of August 2023 advising schools on how to find out if they have RAAC, and what to do if it is identified.

This guidance was triggered by the results of a Department for Education (DfE) questionnaire sent to schools in 2022.

RAAC is a lightweight, “bubbly” form of concrete commonly used in construction between the 1950s and mid-1990s. It is predominantly found as precast panels in roofs, commonly found in flat roofs, and occasionally in floors and walls.

In some cases, the RAAC is so severe that schools have had to close parts of their buildings. Of the 231 on the list, the DfE has confirmed that 228 settings are providing face-to-face learning for all pupils, while three

settings have put hybrid arrangements in place.

Speaking in October, Secretary of State for Education Gillian Keegan said that she wanted to “reassure pupils, parents and staff” that the government was doing “whatever it takes to support our schools and colleges in responding to RAAC” and “minimise disruption to education”. She added that “every school or college with confirmed RAAC is assigned dedicated support” from the DfE caseworkers.

Paul Whiteman, general secretary of the NAHT school leaders’ union, said: “It is pretty embarrassing for the government that we are now almost at the end of the autumn term and it is still adding schools to this list – and the Secretary of State has today told the education committee that this figure will continue to rise.

“We were promised urgency and immediate repairs and yet there are still schools waiting for mitigations to be put in place. It underlines the government’s failure to set out a timetable for how long this will continue, let alone the long-term plan and fresh investment desperately needed to ensure the school estate is safe and fit for purpose.”





THE SCHOOL IS DESIGNED TO PROMOTE INCLUSIVE EXTERNAL PLAY AND PROVIDE INSIDE AND OUTSIDE SPACES THAT ENRICH PUPILS' HEALTH AND WELL-BEING, AS WELL AS DELIVER THE FORMAL CURRICULUM.

A CAPITAL TRANSFORMATION

From a dark and sub-standard school building to a welcoming, light and safe learning environment, the new home for Edith Neville Primary School, in the London Borough of Camden, is unrecognisable from the previous building built in the 1970s. The editor of this issue, Jonathan Nicholls describes its journey of transformation.

"Its effect has been profound," says Ruby Nassar, the headteacher at Edith Neville Primary School in central London. "Some parents cried when we first showed them around." Until recently, the school was housed in sub-standard accommodation which had been identified for replacement for decades. Anti-social behaviour took place in the neighbourhood and close to the school's boundaries, it felt hostile after dark and pupils said they didn't always feel safe. Today, however, the school building is welcoming and light. It's safe and secure, while also being open and accessible to the community.



So what's the story behind the transformation? Well, the development is part of the London Borough of Camden's £89 million Central Somers Town regeneration masterplan. Located between St Pancras station, the Crick Institute and Euston station, Central Somers Town is a short walk from some of London's busiest landmarks yet it is one of the city's most deprived and neglected neighbourhoods.

The regeneration initiative provides a rebuilt school (Edith Neville), new public open spaces, community facilities and 130 new homes, making it a flagship for Camden Council's Community Investment Programme (CIP) and a key milestone in redressing the historic inequality of the area.

As well as a new primary school, the building also houses a nursery, family centre and parent drop-in, providing the community with a state-of-the-art learning environment and the school a secure basis on which it can thrive into the future.

Consulting on the vision

The building design is based on a shared "manifesto", specific to Edith Neville Primary School. It evolved

from a detailed consultation and co-design process undertaken between Hayhurst & Co Architects and the school community.

Over two years, key objectives and a vision for the educational environment were established, covering subjects such as pedagogy, nature, community and well-being, as well as focusing on the school's ethos and community outlook.

As architects we studied how the school worked, observing classes, break and lunchtimes, and the start and end of the school day, to understand how pupils and teachers used their building and where positive behaviour and pedagogy specific to the school might be supported and enhanced by the designs for the new building.

With the school's senior leadership team, we visited other educational buildings, all designed to support learning, to identify specific requirements for the new school's design. This established the idea of a "grown-up learning environment", views in and out of the school site and the importance of a large and uplifting entrance that provides a sense of joy.



The rest of the school staff took part in workshops where we showed examples of classrooms from around the world and asked them how they interpreted their “ideal classroom”. Overall, staff identified the need for individual outdoor teaching environments, breakout spaces for one-to-one learning and spaces that would support good supervision within the school.

Pupils were also at the heart of shaping the design: they were invited to look at different areas of the school and explore how the building might be improved. A workshop we held with pupils at the start of the design process included model-making, writing stories and poems, and an exercise to measure and draw. Once all the workshops had been delivered, the pupils, staff and architects assembled in the hall to present their work and share their ideas.

Inside and outside

So what does the school look like today? The building was developed around a courtyard, an “oasis”, which welcomes families into the heart of the building and provides parents with a safe and secure access point to its various facilities, while also providing a place that

accommodates pick-up and drop-off of multiple siblings simultaneously.

The school is designed to promote inclusive external play and provide inside and outside spaces that enrich pupils’ health and well-being, as well as deliver the formal curriculum. Beyond the classroom there are internal and external group breakout spaces directly accessible from every class base, creating opportunities for different forms and scales of teaching, learning and experimentation. This continues in the playground areas, which provide a variety of landscape types. These encourage alternative modes of social interaction, nurture those pupils with less confidence as well as provide space for more active, physical play. The external spaces include a “country garden”, a “potting shed” and fallen logs.

Every space in the school is used as a learning opportunity. The main route between the entrance and the assembly hall was widened to become a gallery for large-scale hanging artwork and to create a space in which parents could mingle in the heart of the building.





“THE CHILDREN ARE NOTICEABLY CALMER AND HAVE GREATER SELF-ESTEEM, NOT LEAST BECAUSE THEIR SCHOOL IS NOW A MATCH FOR THE FLASHY BUILDINGS SPRINGING UP ON EVERY SIDE OF SOMERS TOWN.”

Similarly, classroom storage walls are punctured to create a “shop front window” for each class to present their work, and windows and rooflights mediate long and short views to make teaching spaces feel part of the extended landscape and wider city.

Lean, clean and green

Central to the brief for the building is that it is able to expand to a two-form entry school in the future, if required to meet local demand. The building can extend upwards through the addition of an extra storey, and all the building’s circulation routes, structural-bearing capacity, fire loading and the area allowance for shared spaces have been built so that the school can accommodate this future change without significant intervention.

Adaptability and flexibility have been built into the teaching spaces through the arrangement of the structure and the insertion of concealed openings in classroom walls. This design foresight will make it easy to adapt teaching spaces should pedagogies change in the future or if there is a desire to combine class cohorts as the year groups expand.

To ensure that there were exemplary levels of natural daylight and a close connection to greenery, a “Be Lean, Be Clean, Be Green” approach was taken that utilised modern methods of construction (MMC) and the use of cross-laminated timber (CLT) in the structure. This included a thermally efficient envelope and glazing and roof overhangs arranged to maximise passive daylighting and cross-ventilation while minimising overheating and glare. This passive approach is supported by a building management system (BMS) that controls actuated natural-ventilation chimneys, night-time cooling and occupancy-sensitive LED lighting to maximise the efficiency of the design.

The new school building is designed as part of a parkland masterplan and is therefore closely connected to its wider urban ecology. The white, filigree site enclosure and building envelope provide a multi-layered backdrop to the public spaces they face. Planting is strategically placed to grow up and through the façade, creating pieces of vertical park, while carefully considered openings through the bespoke perforate fencing allow visual permeability without compromising the school’s sense of and need for protection.



The sculpted building form is designed to maximise access to planted courtyards, roof terraces and covered play directly from teaching and staff spaces. This connection to greenery continues onto and through the site's boundary screen, linking it to the surrounding park. Over time, as the planting matures, this framework will continue to blur the division between school and park – creating a green elevation that improves air quality and habitat provision, while also acting as a natural and calming privacy screen.

The school was completed in late 2021 and is much loved by the school community. The design has caught the eye of judges across the industry. It won a Royal Institute of British Architects' (RIBA) National Award 2023, and the New London Architecture (NLA) award for the Best Education Building in London in 2023 and the NLA Wellbeing Prize for the contribution the school has made to the well-being of its pupils and its local community.

But perhaps Nassar puts it best: "The children are noticeably calmer and have greater self-esteem, not least because their school is now a match for the flashy buildings springing up on every side of Somers Town." ■

*Jonathan Nicholls is a director at
Hayhurst & Co Architects*



AS WELL AS A NEW PRIMARY SCHOOL, THE BUILDING ALSO HOUSES A NURSERY, FAMILY CENTRE AND PARENT DROP-IN, PROVIDING THE COMMUNITY WITH A STATE-OF-THE-ART LEARNING ENVIRONMENT AND THE SCHOOL A SECURE BASIS ON WHICH IT CAN THRIVE INTO THE FUTURE.

ENCOURAGING CHILDREN TO IMAGINE SPACES IS A GREAT WAY TO ENGAGE CREATIVELY WITH YOUNG PEOPLE.

BUILDING THE BOARDS

Brixton House gained a new performance space thanks to the hard work of pupils from four primary schools in London. Matthew Springett and Fiona MacDonald explain more about the project.





“Encouraging children to imagine spaces is a great way to engage creatively with young people.” That was Matthew Springett and Fiona MacDonald’s key takeaway after working on the design and build of a new theatre with a group of children aged between eight and 11 years old.

Springett and MacDonald are the co-founders of MATT + FIONA, an award-winning social enterprise that asks young people how their built environment might be improved, and then empowers them to bring that vision to life.

The particular project saw pupils from Christ Church Streatham CofE Primary School, Hill Mead Primary School, Richard Atkins Primary School and St John’s Angell Town Church of England Primary School set a brief and design and build a performance space over five years. The children were supported by MATT + FIONA and a group of 60 volunteers, and during the build they learned, working as a team, how to measure, cut timber and create complex frame structures.

The finished space is beautiful and colourful as well as fully accessible and interactive. It is situated in the modern theatre Brixton House in the district of that name in South London, and has been used to engage and inspire young people in the area, hosting performances and activities by local youth groups and schools.

“Having worked with these four primary schools in Brixton for the last five years – before, during and now after the pandemic – we cannot wait for the children to finally see their performance space realised,” say Springett and MacDonald.

“Their vision for the space and its contribution to their community has been unwavering throughout. It will be a testament to their perseverance, resilience and creativity, skills we need now more than ever. We hope that projects like this will become far more commonplace for schools across the UK.” ■



THE CHILDREN WERE SUPPORTED BY MATT+FIONA AND A GROUP OF 60 VOLUNTEERS, AND DURING THE BUILD THEY LEARNED, WORKING AS A TEAM, HOW TO MEASURE, CUT TIMBER AND CREATE COMPLEX FRAME STRUCTURES.



SPROUTING OUT OF THE LANDSCAPE

The Reggio School in Madrid is a building that looks like no other. Irena Baker speaks to its architect to discover what lies within.

Rising out of the earth like a stack of giant, googly-eyed bath sponges, the Reggio School in Madrid is one of the most intriguing buildings you could encounter. Described by *The Guardian's* architecture editor as "one of the most inventive schools ever built", its gloopy yellow cork façade spotted with bubble windows makes it look almost alive.

Shiny ventilation shafts – reminiscent of the Pompidou Centre in Paris – poke from the roof, lending it a "fun factory" feel. Small gardens throughout the structure provide playful tufts of green, making it blend naturally with the surrounding land. But the elementary and middle school (for children between the ages of two and 18) in the suburb of Encinar de los Reyes is not the work of some wacky architects having an £8 million laugh. The result of a two-year design collaboration between architects, teachers, pupils and parents, it has deeply serious educational and environmental goals.

A place for experimentation

The private school was set up by a cooperative of teachers subscribed to the Reggio Emilia educational approach, which emphasises self-directed, experiential learning driven by relationships with others. The physical environment is imagined as "the third teacher", with spaces configured to encourage interaction, open-ended exploration and connection with the outdoors.

These principles are clear in the new school, which emphasises public collective spaces. A large "agora" on the ground floor provides a meeting point for assemblies, theatre and sport that leads out onto a loggia or covered balcony with views out over the landscape.

The third floor is home to a miniature temperate rainforest, which rises two storeys in a covered courtyard, with laboratories and workshops accessed off a deck around the edge.

The building was specifically designed to encourage serendipitous behaviour, according to Andrés Jaque, the architect whose Office for Political Innovation in Madrid is well-known for its experimental projects. "Schools normally are designed as functional spaces like hospitals and prisons with a mandate of optimising everything and having one way of circulation," he says.

"We thought it was very important that spaces should be bigger than the minimum and there should be many different ways to go from A to B and many things in between. So we ended up avoiding corridors. To go to the garden you have to go through the library... there's all this production of serendipity that was very important."

An ecosystem of possibilities

He says that the decision to make the library almost part of the playground had been "incredibly successful", encouraging playful activities among children of all ages. "They started to hide books all around the building, so there are many kids trying to find the books that other kids left in secret places around the building," he says.

"There are new forms of recreation, of having fun, across age groups, that grew because the library was designed as a space of playing rather than a serious space to work. For me, those kinds of things show the potential of the design of the school as an ecosystem of possibilities rather than a functional space that is anticipating the way it will be used."





JAQUE STRESSES THAT THE DESIGN OF THE BUILDING WAS NOT JUST ABOUT REDUCING ITS ENVIRONMENTAL IMPACT. INSTEAD IT IS ACTIVELY WORKING AS “AN ENVIRONMENTAL REPARATION DEVICE”.





The somewhat “raw” nature of the inside spaces, with the structure and services exposed, is deliberate and directly feeds the idea of the school building as a teaching tool. The concrete lower levels have been left raw, the lightweight steel structure of the upper floors is evident and pupils can see how everything “works”.

The other benefit of this “less-is-more” approach is its sustainability: the lack of dropped ceilings, wall linings and other finishing elements has meant a 48 per cent reduction in the materials used.

The unique, recycled, pulverised cork cladding also has big environmental benefits. Developed by the Office for Political Innovation for the project, the cork cladding provides double the regulation thermal insulation and reduces energy consumption for heating by 50 per cent.

The compact, vertical nature of the six-storey school, which has a relatively small footprint, makes economical use of land. But Jaque stresses that the design of the building was not just about reducing its environmental impact. Instead it is actively working as “an environmental reparation device”.

The tiny gardens dotted around the building are specifically designed to nurture the wildlife that had disappeared from the large public park next door due to pesticide use in nearby private gardens. “We thought it would take decades but already this summer we were observing the huge increase in biodiversity in the park... it’s amazing when you work with the right knowledge, tiny gardens can have a huge impact,” he says.

The striking yellow cladding has much more than an insulatory role: it will become a habitat where fungi, lichens, mosses and other organisms should

flourish. Rainwater flows down the cracks in the cork, encouraging life.

The exterior is Jaque’s favourite aspect of the design, which was the result of a long process of experimentation and prototyping. He criticises the trend for shiny titanium façades and says these designs have a “huge environmental impact and produce façades that are dead”.

We can expect the colour of the building to change over time – losing its custardy look and turning green and brown. “The cork will become an ecosystem very fast,” says Jaque.

This is one of the many aspects of the building which are now inspiring educators and architects the world over. “The reaction of kids and parents and teachers has been amazing and the school is becoming a place of pilgrimage for people who are interested in the relationship between pedagogy and architecture,” says Jaque. Indeed, it will be fascinating to see if similar schools sprout out of the landscape elsewhere in the world any time soon. ■

THE PHYSICAL ENVIRONMENT IS IMAGINED AS “THE THIRD TEACHER”, WITH SPACES CONFIGURED TO ENCOURAGE INTERACTION, OPEN-ENDED EXPLORATION AND CONNECTION WITH THE OUTDOORS.



DESIGNING FOR DEAF STUDENTS

Attendance, behaviour and well-being have all improved tenfold at the Deaf Academy in Exmouth. As Irena Baker finds out, it's thanks to a new building with student needs at its heart.

"Students didn't respect our old building," says Mark Stocks, partnerships and community manager at the Deaf Academy special school in Exmouth. "It was falling apart. They would scribble on the walls, or chuck things around. But since we moved onto our new site three years ago, behaviour has improved significantly due to pupils being in an environment which actually suits their needs."

School refusers are now asking to come to school, parents report much better behaviour at home, and staff say well-being and the sense of community has improved, he adds. This turnaround was mirrored in the charity-run school's most-recent Ofsted report in February 2023: after a bumpy few years, it was rated good for the first time since 2014, with inspectors describing it as "a place of inspiration" for pupils. It scored "Outstanding" for behaviour and attitudes and personal development.



While management and staff have worked hard to achieve this, its unique new building, specially designed to remove the barriers to learning faced by deaf people, has also played an essential role in the academy's change of fortune.

Questions and important answers

So how exactly do you design a school for deaf people aged between four and 25 who use British Sign Language (BSL), many of whom also have other physical and multi-sensory impairments?

This was the question that Carl Harding, the project architect from Stride Treglown, asked the school management when the practice made its pitch to design the school in 2016. Although his team consists of experienced designers of schools, none of them had actually created one for young people with hearing impairments. "We were told that we won

the job because we went into the interview and asked them lots of questions... we presented our approach rather than a design," he says.

The architects then held a long consultation in which they engaged with staff and students to understand their needs over around eight initial engagement meetings, held every two weeks. These included a visit to the Deaf Academy's existing building in nearby Exeter to see its narrow, dark corridors, small classrooms and bad lighting.

For inspiration they also studied various precedents including the Frank Barnes School for Deaf Children in London, and looked at the latest research into global best practice. Specifically, they drew on the DeafSpace design principles devised by architect Hansel Bauman and Gallaudet University in Washington, DC, which provided key guidance in





terms of space, circulation, maximising the use of tactile and visual cues, and the importance of good light and acoustics.

Designed with BSL in mind

The finished academy – a single, two-storey, new-build block with a linked, refurbished theatre building and a separate new residential block – takes all of these requirements into account, often to impressive aesthetic effect.

Enabling the use of BSL, a visual medium, is at the core of the design. For example, classrooms have to be big enough and the furniture flexible enough to allow for teaching to take place in a “horseshoe” shape, so that everybody can see everybody else.

Small “hoods” carefully positioned around the windows ensure that spaces receive natural light but also reduce the glare and direct light that might interfere with sign language conversations. The architects had to avoid the use of harsh spotlighting that might cause shadows and silhouettes.

Colour selection was also important: “Having a gaudy fluorescent pink background isn’t brilliant if you’re looking at somebody signing all day and trying to understand what they’re saying,” says Harding.

Circulation routes were also designed to further facilitate moving and communicating. Corridors were built far wider than the mainstream school Department for Education (DfE) minimum standard of 1.8 metres to allow for two pairs of people to hold BSL conversations as they walk along them in opposite directions. And to enable safe circulation in corridors for students lacking auditory cues, sharp corners were replaced with curves to reduce the risk of collisions because increasing the field of vision helps to compensate for the lack of auditory cues that someone is approaching in the other direction.

The role of acoustics

While it was important that loud noise was kept to a minimum, the school makes use of hard surfaces to



allow students to use vibration to have a sense of what is going on around them. Also, gloss finishes were deliberately installed in the kitchens in the residential apartments to give people the sense of movement of others around them, through light reflecting off the surfaces.

At the same time, students with cochlear implants or hearing aids could find loud reverberations too stimulating, so great acoustics were essential. This can be seen in the school's central "learning forest" atrium area, where a vast wooden "tree" appears to grow towards the ceiling. Acoustic rafts hang from its branches like leaves, while coloured lights are its "fruits".

This central area, inspired by an earlier design by DRMM architects for a previous plan to build the academy on a site in Exeter, is Harding's favourite part of the school. "It just works really really well," he says. "The lighting and acoustics in there, it's a massive space but there's no reverberation whatsoever."

Niche design principles with broader applicability

But what was the biggest challenge of the design process? The ever-changing complex nature of the student intake entailed maximum flexibility in the design and furnishings, says Harding.

Out of 66 students, 45 per cent have social, emotional and mental health needs; 30 per cent have multi-sensory impairments (MSI); and a quarter have autism. Pupils are working on anything from P Levels (below Level 1) to Level 1 and 2 qualifications. "There's a wide spectrum of need as well as deafness," says Stocks, explaining why the school is also fully equipped with areas for physio and personal care.





So what are the overarching lessons from the design and build process? “We’ve got an ageing population so there’s a higher proportion of people living with hearing loss,” says Harding. “We should really be thinking about designing all public spaces to suit these principles.”

Perhaps most importantly, staff and students are delighted with the building that had been promised for some years. “It’s been a long bumpy road but the end result is that we’ve got one of the most amazing educational spaces in the whole of the UK, if not Europe,” says Stocks.

“It truly is unique.” ■

...CLASSROOMS HAVE TO BE BIG ENOUGH AND THE FURNITURE FLEXIBLE ENOUGH TO ALLOW FOR TEACHING TO TAKE PLACE IN A “HORSESHOE” SHAPE, SO THAT EVERYBODY CAN SEE EVERYBODY ELSE.

Built in the 1970s, the greenhouse at St Mary's School in Cambridge stands tall today as the award-winning Yingting Qian STEM Lab. Clare Cook finds out about its transformation.

THE SIMPLE BUT EXQUISITE GREENHOUSE

Generally speaking, a greenhouse is a pretty modest, simple building. Popular with green-fingered gardeners across the world, panes of glass fit together to provide an optimum environment in which to grow vegetables, fruit and plants alike. However, the one that stands tall in the grounds of St Mary's School in Cambridge, an all-through independent school for girls, is anything but simple. While it indisputably looks like a greenhouse, what it houses inside is quite different.

Originally built in the 1970s, in 2022 the greenhouse underwent a huge transformation to become a contemporary, practical educational space for STEM (Science, Technology, Engineering and Maths) education. Today, it is officially known as the Yingting Qian STEM Lab, named after an alumnus who helped fund the project, and it serves as an incubator for students to experiment, explore, design, test and refine their STEM-related ideas.

Innovative retrofitting

Assessing and meeting the needs of the students was at the core of the design from the very start, says architect Alexander Giarlis. "There are the objectively established needs that come from regulations, guidance, standards and research on classrooms and STEM activities, and then there are the subjective needs of the specific teachers and pupils of this classroom," he says.

With colleagues, Giarlis ran workshops with school staff in which information, desires and needs were expressed and exchanged. Arguably, he adds, the most important stage was when the plans moved on to look beyond needs: for example, the innovative aspects of the design which break boundaries and create new

standards – like having the entire room function as a STEM tool in itself.

When bringing the design to life, Neubau Architecture preserved the building's unique character by protecting the concrete slab foundation and retaining the aluminium frame. However, to bring the building into the twenty-first century, the delicate glass panels were replaced with a robust polycarbonate façade system, resulting in a substantial reduction in the building's carbon emissions.

The design strategy centred on inhabiting an industrial frame by inserting an internal secondary structural skin with multiple functions, including insulation, storage and fold-out desks. The lab also accommodates dedicated spaces for an array of scientific instruments, seamlessly integrating tools for measuring time, temperature and humidity.

It was built to have dual functionality: for example, the flooring doubles as a practical tool for measurements and plotting graphs, while the central roof truss provides a unique space for gravity-related experiments, with the flexibility to hang items from the ceiling.

The scale of this work is not to be underestimated, and while Giarlis admits it was challenging, he believes the approach should be replicated elsewhere. "Retrofitting is not as widely practised as it should be, and the simple reason is because it is much harder to design around an existing structure. The old greenhouse frame was no exception – and it was by far the most challenging aspect of the design process, but worth every effort," he says.







"In the current environmental crisis we find ourselves in, the retrofit approach should be a default. There are significant carbon emission savings to be had by reusing existing buildings, which already contain embodied carbon emissions from their original construction."

"...simple but exquisite"

St Mary's girls love to learn in the thoughtfully crafted lab, which enables them to gain practical experience with a myriad of innovative STEM experiments. Students struggle to find a fault with the new space, says physics teacher and leader of St Mary's junior after-school club Tessa Shercliff. "The students enjoy the interactive space, and they love coming to a different place for their specialist lessons in both STEM and computer science," she says. "They enjoy the varying room setups for different lessons, and value having the facilities to showcase their work in an innovative way."

The dedicated lab facilitates an early introduction to STEM subjects, and is absolutely crucial to inspiring more girls and young women to pursue future careers in these fields, she adds.

And as a teacher, she appreciates the innovative space too. "The room certainly helps me to teach. There is a large open space with moveable benches so that I can arrange the furniture depending on the lesson," she explains. "I have storage, allowing resources to be easily accessible. I have space to display the students' work and keep work in progress. The light, airy space is a lovely, inspiring place to be."

The space is one of excellence in innovation. The design was recognised as "Highly Commended" at the 2023 AJ Retrofit Awards, with the judges calling the space "simple but exquisite". ■

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THE BIOPHILIC CLASSROOM

What are the learning benefits of introducing nature into classroom design? Clare Bowman shares the findings from her research conducted with Putney High School.

Nature in a space is tangible; from a stimulating view of nature to the use of plants, water features, natural air flow or breezes, sounds and scents. By mimicking the finer details of natural analogues with textiles, artwork, light, shapes or patterns, designers can create a connection between nature and the modern built environment. This is biophilic design.

It's not hard to find examples of this work in buildings across the world: increasingly, spaces are designed and built with nature in mind. But what about schools? Could a learning space ever be truly biophilic? And if so, what would the impact be?

The Flourish Model

In 2018 my team and I carried out a nine-month study at Putney High School to find out. We took three physically and demographically similar Sixth-Form classrooms, and carried out objective and subjective examinations throughout the academic year.

The study is based on "The Flourish Model" of calming the mind in order for the imagination to thrive, created by Derek Clements-Croome, Professor Emeritus of Architectural Engineering at the University of Reading. The theory promotes the creation of a calm, natural and harmonious environment to stimulate the alpha brain waves (high relaxation) and lower the high beta brain waves (high stress).

The overall aim of the study was to create refreshing learning environments while gaining greater evidence to support the belief that biophilia can reduce stress, improve cognitive function and creativity, improve well-being and expedite healing.





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The 14 patterns of biophilic design

Inspired by principles set out by green consultancy firm Terrapin Bright Green in its report *14 Patterns of Biophilic Design*, changes were made to two classrooms. The third was kept as a control space for comparison. The 14 patterns are as follows:

Nature in the Space Patterns

1. Visual Connection with Nature
2. Non-Visual Connection with Nature
3. Non-Rhythmic Sensory Stimuli
4. Thermal and Airflow Variability
5. Presence of Water
6. Dynamic and Diffuse Light
7. Connection with Natural Systems

Natural Analogues Patterns

8. Biomorphic Forms and Patterns
9. Material Connection with Nature
10. Complexity and Order

Nature of the Space Patterns

11. Prospect
12. Refuge
13. Mystery
14. Risk/Peril

The importance of air quality

"Nature in the space" was introduced to a maths classroom in the form of plants: using guidance from a landmark NASA study by Dr B.C. Wolverton in 1989, "Interior Landscape Plants for Indoor Pollution Abatement", 19 plants were introduced to the maths classroom, one plant per six cubic metres. A "natural analogue" in the form of a woodland photo mural was added to an English classroom.

As well as changes in classroom design, other steps were made to improve air quality, which was a particular area of concern for both staff and students. Often, complicated mechanical solutions for schools are recommended in cities due to poor air quality, but it was important to the school to examine simpler, user-friendly solutions.



Prior research by Usha Satish and others at SUNY Upstate Medical University in the USA found that CO₂ levels affect decision-making when as low as 600ppm. The Sixth-Form building already utilised a natural ventilation unit system that provided good levels of indoor air quality (IAQ) and humidity, which automatically maintained UK standard levels of CO₂ 1,000ppm (summer) and CO₂ 1,500ppm (winter). However, a small change was introduced: setting the system to kick in when CO₂ reaches 750ppm in the spring term. Efforts were also made to increase the number of trees on campus, particularly in areas adjacent to the road.

We measured the impact of all of these changes in several ways.

We monitored the comfort of students with fixed data loggers for temperature, relative humidity and CO₂. Bi-weekly spot meter readings were taken of IAQ, formaldehyde (HCHO), total volatile organic compounds (TVOC), PM_{2.5} and PM₁₀ (pollution levels).

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Those who used the buildings completed questionnaires on the perception of the classroom design, occupant comfort, health, attention, cognitive and emotional well-being, and the introduction of biophilia. Further observational studies of attention were also undertaken using the Leuven scale for well-being, developed by Professor Ferre Laevers at the Leuven University in Belgium.

The benefits of biophilic design

Overall, the study found that there were benefits to both nature in the space and natural analogue design. Of the two biophilic interventions, we found that nature in the space had a closer association with students' cognitive well-being while the natural analogue had a stronger relationship with students' emotional well-being.

Internal and external air quality surveys found that when 15 metres of trees separate the school from the road, the air quality improved by an average of 23 per cent. And the use of plants and a passive ventilation system set at 750ppm improved IAQ by an average of 58 per cent.

The majority of students (96 per cent) expressed a positive response towards the design of classrooms, and 91 per cent expressed a positive response towards the comfort of classrooms.

The survey found that 78 per cent felt healthier, 68 per cent liked the wall mural in the English classroom and 62 per cent liked having plants in the maths classroom. Just over half (51 per cent) felt that the air quality had improved in the classroom.

We believe the study has shown that the subtle reintroduction of nature can enhance the quality of learning environments to benefit health, productivity, cognitive and emotional well-being.

Our research was only possible with the shared vision of leadership across Putney High School and the Girls' Day School Trust (GDST), which continue to implement biophilic design principles throughout the campus, and even now have an ecologist in residence providing first-hand outdoor learning. ■



Clare Bowman is a lecturer of Sustainable Architecture, at De Montfort University, and an Architect and Sustainability Advisor at RCZM Architects.

on reflection

TRULY STUDENT-LED

We have been busy with a student-led project, Brain Food, in one of our SEK International Schools in Spain in which older primary pupils were tasked with a redesign of one of their learning spaces on a tight budget. Once the hard work was over and the redevelopment was in progress, I was chatting to the delighted children and one of them said to me: "You know, I've been in seven schools so far in my life but this is the first time anyone has asked me how it could be better." He then leaned in close and added in a quiet voice: "But I've always known..."

The project was a great success. What was already an excellent space became yet more effective. With the learners' voices at the heart of the changes, the children had agency and engagement. It wasn't as simple as just asking children for their opinions. They researched and then video-called others around the world who had radical ideas to share from their own schools. Seeing children across two continents critiquing their learning spaces was a joy. It went far beyond the usual strategy of running finished ideas past the schools council or a small focus group: it was truly learner-led.

When you surprise children with trust and a research role, they can astonish you with the quality of their

suggestions, solutions and engagement every time.

They have new ways to share and exchange, and new solutions we can learn from.

In our project, the students leading the research even went beyond video calls and created their own dedicated BrainFood YouTube channel as they became minor global influencers.

The pandemic has amplified our student voices more than ever. I visited a secondary school last year, and out of a roll of 900 more than 100 children arrived daily, registered, but then simply refused to go into classes. They weren't disruptive and they were doing appropriate work in the social areas, but they had effectively said loud and clear: "We are not going to be put back into boxes. This all needs to be done differently."

In England, persistent absence more than doubled from 8 per cent of primary and 13.7 per cent of secondary children pre-Covid-19 to 17 per cent and 28 per cent respectively in 2022–2023. If we don't properly and fully involve our students' voices in improving things, they will build the future of learning without us. They've already started.

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Professor Stephen Heppell is CEO of Heppell.net and holds the Felipe Segovia Chair of Learning Innovation at Universidad Camilo José Cela, Madrid.



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