

PLANNING LEARNING SPACES

FOR ARCHITECTS
DESIGNERS AND
SCHOOL LEADERS

**WE MUST RETHINK
SCHOOL DESIGN NOW**
HERMAN HERTZBERGER



The design of Learning Rooms

At Gratnells, we're a manufacturing organisation which provides a vital element in the landscape and environment of education. We're part of a movement that understands how crucial the physical place of learning is to a child's well-being, safety, sense of belonging and development. What's more, this applies to all children, irrespective of their skills and talents. What we do must take account of the immense diversity that is in our schools and colleges.

Together with a whole range of partners and collaborators we've co-developed new ideas in the application of digital technologies, in the performing arts, in outdoor learning, in all the places where teachers teach and children learn.

"Good school design has a positive impact on educational outcomes and can contribute to a significant uplift in academic progression."

Better Spaces for Learning,
Royal Institute of British Architects



www.gratnells.com

The idea behind Planning Learning Spaces

The idea for *Planning Learning Spaces* was initially born from a sense of mutual frustration and a feeling of regret over lost opportunities. Too often, it seemed that little time had been devoted to drawing up a collaborative vision that married the intended approach to learning and teaching with the physical design. Frequently we found ourselves contacted by teachers struggling to teach in the way that they wanted in new buildings and classrooms that neither supported their educational aims, nor fulfilled their basic needs.

We have both always passionately believed that good school design can play a huge role in improving educational outcomes; it can support and promote innovative ways of teaching that prepare children for their future lives and work.

But equally we have both seen that this doesn't happen unless those delivering the project – designers, architects and civic authorities – work closely with teachers, administrators and pupils at the outset of the project.

Just as we are keen to promote a more collaborative approach to school design, we wanted collaboration to be at the heart of how we compiled *Planning Learning Spaces*.

We have gathered contributions from architects, designers and educationalists around the world, all

of whom clearly share our passion for inspiring good design that 'fits' with what educators are trying to achieve.

It has been both a pleasure and an education to hear from such a broad range of people with so much wisdom and real-world experience to offer.

We don't promise to provide all the answers or a complete blueprint for designing a school, classroom or other learning space. Instead, we hope that this book will help everyone involved in a project to think about the things that really matter and come up with both practical and forward-thinking solutions.

Murray Hudson
Terry White



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Designing Spaces for Future Focussed Schools

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Planning Learning Spaces, the book

Can school design help us to realise a new vision for education that equips young people for life in a fast-changing world?

This is the big question at the heart of *Planning Learning Spaces*, a brand new guide from Laurence King Publishing for anyone involved in the design of nurseries, schools and colleges.

Drawing on expertise and case studies from across the globe, Murray Hudson and Terry White have created a detailed how to manual for designers, architects and school leaders embarking on a new project. Pooling the knowledge of educationalists and innovative school architects determined to improve learning environments, it advocates a collaborative approach to design right from the start of the process.

With advice on everything from engaging school staff to installing technology that supports an educational vision, the varied

contributors put readers on the road to creating future-proofed spaces that are optimal for learning.

The authors also prompt readers to question common assumptions about how schools should look and how children should be educated: Why, they ask, have so many schools changed relatively little in more than a century?

And what form should a school library take in the internet age, if it is needed at all?

Do classrooms, when you think about it, really have to be square?

With these ideas in mind, the book also tackles more mundane but vital elements of learning space design such as how to create the right lighting, heating and acoustics for learning. The key role of furniture, fixtures and fittings is also explored.



Planning Learning Spaces emphasis on the latest research, with contributions from leading minds in education and architecture, creates an invaluable tool to anyone hoping that their project will make a genuine difference to its users now and in the future.

If you can't stand the heat... get a Learnometer

A game-changing device for classrooms is about to arrive.

The long-awaited Learnometer device — the brainchild of education technology guru Professor Stephen Heppell — is set to revolutionise how we see our children's learning spaces.

An all-in-one electronic device which measures and records temperature, humidity, CO₂, air pollution, ambient light and sound, it helps schools identify aspects of their physical learning environments that could hold children back.

Based on the concept of "aggregation of marginal gains" commonly used to help elite sports people to improve, it will help headteachers, staff and pupils tackle



issues such as stuffy, gloomy classrooms, excesses of temperature and noise.

Professor Heppell wants the Learnometer to be used not just to improve classrooms but also as an educational tool. Alongside their teachers, pupils can take charge of experimenting with different changes in their physical environments and analyse the outcomes.

They will be able to look at the Learnometer's readings for their classrooms, analyse them over time and compare them to aggregated anonymised data from schools around the world.

Around 100 prototypes of the Learnometer, which has been developed with classroom furniture company Gratnells, are already positioned in classrooms across the world, providing large amounts of valuable data to Professor Heppell and his research team.

The commercial version of the device will be launched worldwide in early 2020.

"School pupils are often made to perform in 'lead boots', with many aspects of their environment holding them back – there's plenty of research to prove it," says Professor Heppell.

"Pupils should, instead, be treated like middle distance runners, where every aspect of their training is carefully considered."

Learning environments hit the headlines

A national publication has probed the research behind the effect of classrooms on learning.

Everyone who is passionate about optimising learning spaces was delighted to see the topic broached this summer in the UK's leading educational magazine, the TES (formerly the Times Educational Supplement).

The publication featured an in-depth examination of some of the research highlighting the importance of factors such as fresh air, moderate temperatures and good lighting for children's learning.

It also examined less measurable areas such as those discussed in Peter Barrett's Holistic Evidence and Design (HEAD) study, including children feeling a sense of "ownership" of their classrooms.

It also explored ideas such as providing

choice and flexibility in order to produce independent, creative and motivated learners.

Gary Spracklen, headteacher of the Prince of Wales School in Dorset and contributor to the new book *Planning Learning Spaces* also featured, talking about his school's own low-budget efforts to create "marginal gains" in learning through classroom renovations.

Executive head Lisa Woolley who oversees the newly built Cheadle Hulme primary school in Stockport, UK, talked about the role of great classroom design to enhance great teaching.

Academic Wes Imms, who is leading a major research study into the



effectiveness of innovative learning spaces, told the magazine that he was "convinced" he could "solve the riddle of getting quality data" to prove that they have an impact.

To read the TES article in full, subscribe at bit.ly/2kIYYgr

Emotional ceiling

A more standard approach to research would help highlight the importance of buildings' impact on human emotions.

Adopting a more standardised approach to researching the emotional impact of buildings on people could "transform" how industry and governments value the design of interior built environments, a new analysis says.

This could even help in the development of new mental health therapies, the report adds.

The review of studies relating to the impact of buildings on emotions finds that researchers took very varying approaches – making it hard to draw overall conclusions about their findings.

Academics report in *The Journal of Experimental Psychology* that the current body of research does not provide enough "robust evidence" to show the emotional effects of their

visual surroundings on humans.

But they made it clear this did not mean there was no link.

"The field does suggest that emotional state is affected by visual properties that can be objectively measured, and which result in a range of neural and physiological activity," the study says.

It adds that it is "critical" that researchers adopt standard practice so that their findings can be used to evaluate buildings and create new standards for their design in sectors such as education, healthcare, commercial and residential.

The report said: "Countries could transform how industry and government value the design of interior built environments. If the impact of design characteristics can be understood on a neurophysiological



level, this opens the door to understanding if we can support mental health and wellbeing (in both healthy and clinical populations) non-invasively through environmental exposure as a recognised form of therapy."

Reference: *Impact of built environment design on emotion measured via neurophysiological correlates and subjective indicators: A systematic review.* Isabella Bower et al, Deakin University, Australia. *Journal of Environmental Psychology.* [bit.ly/2mooYht]

The power of “unofficial” space

Design experts Charlotte and Peter Fiell interview the legendary architect Herman Hertzberger.

I can see at a glance the ethos of a school just by looking at the classrooms.

Can school design help us to realise a new vision for education in a fast-changing world?

It is not often one gets the chance to meet and interview one of the great humanist architects of the twentieth and twenty-first centuries, but recently, we were lucky enough to get that chance.

To celebrate the publication of a new book on school design entitled ‘Planning Learning Spaces’, we were asked to go to Amsterdam to interview Herman Hertzberger.

The venerated Dutch architect is the leading pedagogic thinker in professional practice famous for his Montessori School in Delft and the Apollo schools in Amsterdam, among others.

More than any other person working in the field of school design, Hertzberger has had a remarkable impact on how

we now plan learning spaces. Indeed, his radical ideas from the 1960s and 1970s are seen as pretty much a given by today’s architects working within the realm of educational buildings.

Having spent the last 60 years putting state-of-the-art pedagogic theory into practice, Hertzberger probably knows more about school design than anyone else on the planet.

Now at the age of 86 years old, he is still actively engaged in a host of new projects and is currently writing another book on his own design philosophy. To follow is a distillation of our interview, outlining his insights into how to design better, more intelligent learning spaces.

HH: I’m at this moment working on a book and its first chapter is called “Sources”, because I’m convinced that where ideas come from is completely rooted in the home. It’s all prepared by your surroundings. It is your whole education, your whole environment that feeds your brain. And, of course, it is one’s openness to ideas that decides what you can and what you can’t think.

CF: You’ve said it helps educationally to be content as a child, maybe you could explain what you mean by this.

HH: It helps if you have the right parents, the right education. For me, it started in my Montessori school. When you say Montessori, people say: “Oh, it’s Italian, it’s expensive, it’s this and it’s that”. But the fundamental individual-centred ideas behind it let me do what I eventually did.

CF: And that was because it was teaching you how to think, rather than teaching you facts?

HH: There are basically two ways to educate people. One way is to tell them how the world works – a sort of “this is how it is, so remember!” And the other way of education is to let people develop thinking for themselves in their own direction. This has the risk that they might become an anarchist or part of any other

extreme way of thinking, but you should take that risk. I was luckily enough to have been educated at a time when there was this new belief that as a child you should be allowed to develop your own spirit. Today, education is rather tending towards the opposite direction, “You should get a good job, so you should be conformistic.” So, schools are becoming more disciplined and there’s a return to a stricter kind of “old school” education. As an architect who has spent his whole career designing schools, when I enter a school I can see at a glance what the ethos of the place is just by looking at the classrooms.

PF: Their design?

HH: Or how they’ve been arranged. When all the students are sitting in lines looking at the blackboard, then you have the strictest kind of teaching.

CF: Which is totally counter to the idea of self-learning, as postulated by Maria Montessori who believed that children’s mental capacities had, if I understand rightly, a sort of educational optimal time slot?

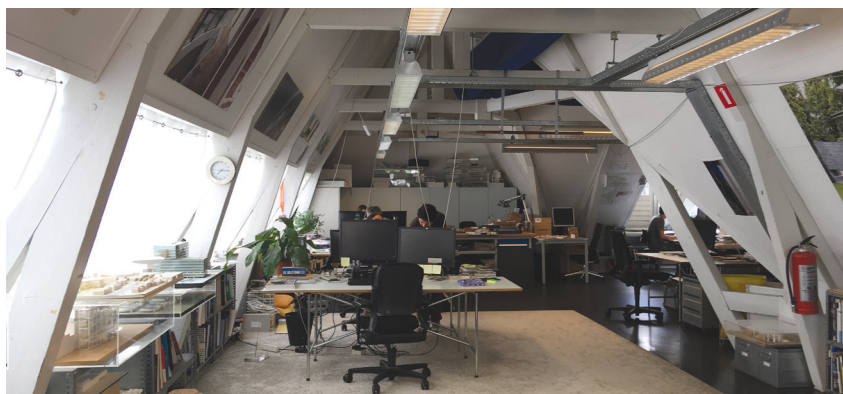
HH: What she meant was that your brain is like an information carrier, which at certain moments can process information. So, at very specific moments you learn specific things. But also when you miss the right moment this gap cannot be repaired afterwards.

CF: Presumably this has over the years led to more project-based teaching, which has transformed how a school needs to be set up.

HH: Exactly, so when I’m designing something, it is always related to what people will do with it, what people will think of it. The actual design is never up-front because for me, form, space and people are absolutely complementary.

PF: You are well-known for introducing raised “islands”, sunken “pits” and large-stepped “grandstands” into the educational environment and I’m just wondering if it’s the simplicity of these features that makes them so compelling to interact with. Because they’re not difficult to understand, yet they’re unexpected.

HH: Yes, it is all about creating “unofficial” space. Most things in space, like objects, are defined and also possessed by



something. So, for an architect all the things in a building are to some extent possessed by their conceptual significance. So that when you see the thing, you immediately know exactly what it is. However, what I try to do all the time is to create things in buildings that are not possessed per se but can instead be possessed by the people who use them, who interpret them for themselves.

CF: One of the most notable things about your career is how you have always embraced the possibility of future change, which a lot of architects are not so keen on countenancing. They want to create fundamentally static monuments, whereas you design-in flexibility to address change, even if you don’t know what that change will be in the future. And that’s quite an unpretentious approach to thinking about buildings.

HH: This idea of change is a continuation of the idea of interpretation. I’ve learnt over the years that people will want to change your buildings over time, because functional needs and concerns evolve. So, the next step is to design in such a way that allows change.

PF: Do you think for learning spaces more adaptiveness can be achieved somehow, perhaps in relation to static fixtures versus movable, modular elements? Is there something that could be done there that could make spaces perform better?

HH: You used to have in the United States during the 1950s and 1960s schools with completely open spaces and they don’t work, because people are sort of disturbing each other. So, you have to articulate the space in such a way that different groups or individuals can work,

while having an eye on each other, yet not being disturbed. I try to make undefined spaces, which can then be defined by moments, by the situation at any one time. The point is that you can facilitate freethinking education, which tries to develop people individually, by making a space or a room that is not defined. In other words: a space that can be temporarily defined personally by the user. For some of our school projects, both old and new, we’ve taken a large space and put in lots of sunken or island-like elements, or marked areas in it in other ways, which invite people to group together and work together. We were the first to do that, and it’s a feature in all the new schools we are working on.

CF: Does the way you articulate space with pits, islands, grandstands and cocooning areas help with its navigation?

HH: Yes, they help both orientation and domestication. Orientation is also part of domestication and ensures that children never feel alienated in their surroundings. That, for me, is the central idea of architecture. You make spaces that people can feel familiar with and can take emotional ownership of. Make the space their own space. In the end, it’s all about creating the feeling of homecoming. But more than this you are also trying to give a child not only the feeling of home, but also of horizon. It’s important for them to feel safe, but it’s also important to give children confidence, born of spaces that inspire learning for themselves, to look outwards, to seek adventure, new things, better things. So there’s a sort of balance between the homecoming and the going out. Like birds in nests that have to fly out to find their own lives.

Space to explore

Academe meets classroom experience to get to examine what produces creative and independent learners.

What does it take to make independent and creative learners who then go on to be independent and creative adults?

Is it just a question of dishing out the coloured crayons, putting pupils in a relatively flexible, healthy environment and letting them get on with it?

As you might suspect, it's actually down to a subtle interplay between the teaching and culture in the school, the physical spaces the children are learning in and the resources arranged in those spaces.

Professor Peter Barrett, the leader of a major study of the overall effect of classrooms on pupil performance, sat down with his daughter, Raphaella MacKenzie, a practising primary classroom teacher, to compare research with real-life practice.

Creating independent learners:

Raphaella: Giving children the confidence and skills to be independent learners is crucial in primary education, not only to prepare them for secondary school, but also to give them a love of learning that will help them to succeed through their adult life.

Children's freedom of choice is important and is often seen most clearly in the early years, but ideally it should be maintained and developed throughout the entire school.

Peter: In my research the major area of classroom design that links strongly with pupils' independence is "ownership". I suppose it's logical that if children feel they "own" their space, then they can be freer to behave independently.

A classroom where the pupils can say "this is OUR classroom" has to be the aim. In a classroom like this the pupils seem to be more at ease and so ready to work confidently. It certainly impacts

positively on academic progress, and especially in maths, which is often seen as a subject where confidence can be an issue.

Raphaella: Maths is an area where I see lots of successful options for choice and independence in terms of work and resources.

An example of this is avoiding static ability groups with set work in upper Key Stage 2, instead having clearly differentiated options where the children can choose what level of challenge they work at for each particular skill.

A child might choose the highest level of work on money, but the middle option for word problems. Each of these supported choices is a chance for every child to reflect on their learning and take ownership over where they need more support.

Linking this to classroom set up, these choices can be supported by having a "help desk" with a range of clearly set out resources relating to the lesson for children to come and choose from, rather than them being handed out when they may or may not be needed.

Peter: We considered a whole bundle of things that can contribute to the question of "ownership".

To start with a classroom being, say, an unusual shape and the furniture and fittings being good quality and child-centric can all help. Beyond this, and much easier to achieve for most teachers, we looked for simple signs and symptoms of ownership by the pupils, such as: their work on the walls, their names on pegs/trays, joint class art creations, which seems particularly effective at the entrance to signal the start of their domain.

Raphaella: I've seen a memorable

example of this in Year 4, where children jointly created a science display of the human body using elements constructed in their design technology (DT) lessons. It makes sense that using children's ideas and input when creating displays will produce more effective points of reference during independent learning.

Peter: The value of displays highlights the need for ample available wall area but, of course, it is important to avoid making the classroom feel hectic.

Raphaella: There is a fine balance needed for the correct level of stimulation for learning. Here I guess we are trying to give the classroom personality, but not to the point of it becoming too busy.

The other use of displays could be to signpost different areas in the classroom clearly. Have you explored the use of zones and levels of independence within the classroom?

Peter: Absolutely, for us learning zones are the twin to ownership in terms of providing flexibility and so choice. Of course, having options is good, such as wet areas, reading corners, role play spaces, group tables, carpet space for the whole class, break-out space for one-to-one, etc.

But clarity and legibility are very important too, if a chaotic environment is to be avoided.

Oddly we have seen probably the most independent approaches to study with the youngest, Early Years children. Here they typically have a lot of choice as to what they do and where they do it, despite being novice learners.

Raphaella: Yes, Early Years often excel in free flow, zoned areas and encouraging independent exploration. With the pressure of creating measurable progress throughout the school it can

be easy to step further and further away from this as children get older, in favour of “chalk and talk”.

Although independence and freedom in the older years may look different, the acquisition of skills and knowledge should still go hand in hand with child-led learning. This could be through the children giving input into the direction of topic planning, choosing how to access the lessons, and independent work or research projects where they will acquire knowledge but have freedom to research in the way that suits them and how they present their work in different ways.

Producing creative learners:

Raphaella: In my school we are focusing on various learning dispositions that will prepare the children for successful, enriching lives, whatever the future holds.

One such disposition is creativity, often in conjunction with resilience. We aim to create contexts where success is not measured by a page of ticks and correct answers, but by trying something difficult where the pupils have to puzzle through, sometimes independently and at other times within a group.

In what ways have you found classrooms can support opportunities for this type of learning?

Peter: This resonates with some work we have done more recently, closely observing pupils and then discussing with them which spaces they like best. Interestingly, although we had seen some beautiful facilities - for example a complete shop with shelves of tins etc - it was not these the children talked about.

They gave strange examples to an adult's eye. For example, what they called the “den”, which was quite a basic space, but they could draw on the floor, create a roof with materials and use the adjacent white board.

Things like this have led me to think that, actually children react really positively to what could be called “half-made” spaces. These offer opportunities and options, but are not too “finished”. As such they

seem to allow and invite the children to express their own creativity.

Does this make sense in your experience?

Raphaella: Yes, definitely. I know in our early years setting the children's favourite space is an empty, slightly hidden corner behind two of the other zones where they can use their imagination to make it whatever they want it to be. Similarly, in Year 4, the children really engaged with creating “caves” under their tables and a tunnel entrance for their classroom, replicating stone age cave paintings in these places and doing other imaginative work linking to these areas.

In older years, project work is a great way of giving this freedom for creativity, whilst ensuring appropriate knowledge and skills are still covered.

Peter: All this actually links back to the issues of flexibility and ownership that we found strongly support children's learning progress. For the children to have stimulating experiences to encourage their creativity, it must help for teachers to be creative too?

Raphaella: I think teachers are often very creative, enthusiastic people as long as they are themselves given freedom and are not focused on Sats preparation at all costs.

Peter: Getting back to our research evidence about creativity, when we re-analysed our data by subject, “links to nature” showed up as important for “writing”. This makes us suspect that this aspect is important for this most creative of the subjects and maybe more generally. Have you noticed beneficial effects of “nature” on the children?

Raphaella: Yes, definitely. I have experienced children opening up more confidently when working outside, for example when writing poetry on the theme of “love” with my Year 5 class, spreading around on bean bags outside seemed to allow children the physical and mental space to explore their ideas without being embarrassed or distracted by their peers.

Top tips for creative learners

- Use space creatively in your classroom with flexible storage to hand.
- Allow freedom for children's imagination through half-made spaces.
- Bring nature into the classroom to enrich the learning environment.
- Take learning outside when suitable.

Top tips for independent learners

- Allow children to choose and reflect on the level of work they want to work on.
- Set up a “help desk” of support resources to allow children to think about what and when they need something to aid their learning.
- Give pupils input into designing displays to suit their learning and involve their work to create personalised displays.
- Be flexible in organising KS2 classrooms into KS1-style zoned areas to support independent project work.

Professor Peter Barrett spent 27 years as researcher and professor of the Built Environment at Salford University and was leader of the Holistic Evidence and Design project looking at the impact of classrooms on learning. Results published in 2015 revealed that differences in the physical design of classrooms explain 16 per cent of the variation in the learning progress of the pupils in those spaces.

Raphaella Mackenzie is a primary teacher with 10 years' experience in a range of schools. She has a music degree at York University, a PGCE and now works at Bootham Junior School, a private school in York with a strong emphasis on the Quaker ethos.

Professor Peter Barrett

Author of the Clever Classrooms Report

Top 10 ways to innovate the classroom

Along with the more detailed advice and suggestions illustrated here, the key questions to be considered are:

Stimulation: Does your classroom use colour and visual complexity to stimulate without creating confusion?

Individualisation: Through flexibility and ownership can the children interact and resonate with their classroom base?

Naturalness: Does your classroom offer the quality and control of light, heat and fresh air to create a comfortable learning environment?

Ask yourself:

Flexibility

- Can different Learning Zones be created?
- Is there a quiet zone?
- Can different arrangements of furniture be created?
- Is there a variety of furniture?

Ownership

- Do the classrooms have an individual colour theme?
- Is there adequate space for pupils to display work?
- Is there personalised storage space for the pupils?
- Is there good quality, age appropriate furniture?

Connectivity

- Are there class displays in the circulation areas?
- Are the classroom entrances distinctive?
- Can the circulation spaces be multi use/libraries?

Complexity

- Are the class displays on walls too busy or too plain?
- Is the class display material covering too much area (80% or more)?

Colour

- Is the main wall colour calm?
- Has colour been used on the walls to focus attention to the learning wall?
- Are brighter colours used to highlight and stimulate eg furniture/carpets/blinds?

Light

- Is there sufficient natural lighting?
- Is there sufficient artificial lighting?
- Are the light fittings clean and working?
- Are the window areas clear?
- Are there displays on the windows blocking light and views?
- Do the blinds all work?

Temperature

- Does the class overheat?
- Can the heating be controlled from the classroom?
- Is the natural ventilation adequate?
- Can additional external shading be provided?

Air Quality

- Is there a CO2 monitor in the class?
- Do the windows open?
- Do the blinds obstruct the ventilation?

Sound

- Are there any external noise issues?
- Are the floors carpeted?
- Does the furniture have rubber feet?

Links to Nature

- Can the children view/access the outside?
- Can planting be provided in or outside of the classroom?
- Is there an external teaching space adjacent?

PLANNING LEARNING SPACES



Building the foundations of friendship

How a school in the Danish capital Copenhagen, put friendship and wellbeing centre stage in a new build project which has transformed a school.

By Irena Barker and Murray Hudson

“When we have the final exams the children use the round tables, it signals that we are all in this together,” says deputy headteacher Kim Rasmussen, perhaps summing up the overarching culture of learning at Katrinedals Skole in Copenhagen.

While other schools may have sat students in rows facing the front, cut off from their friends, the 950-pupil grundskole is not afraid to do things differently.

Rasmussen and headteacher Rikke Schultz explain with passion how, when planning the new building to house their lower-secondary section, encouraging well-being, friendships and social interactions took centre stage. This, they believe, is the key to getting great academic results too.

The building, home to teenagers in years 7 to 9, (aged 13 to 15) has been built across two floors. It incorporates classrooms that are of traditional shape and size externally (60sqm) but include



an internal bay and side benching to create more seating choices for students.

These classrooms open on to a large shared space where, during lessons,





Display of students' work is valued, encouraging a sense of ownership of the space.

individual students or groups can work in a variety of ways, choosing from comfy sofas, cosy booths or bigger "huts" furnished with tables and chairs.

There are even small "fairy ring" structures to encourage relaxed collaborative working at floor level, S-shaped "love seats" and an oval space with high wooden walls for "secret" meetings and film-viewing.

Display of students' work is also valued,

encouraging a sense of ownership of the space and celebrating newly-learned skills.

A number of cabinets containing stuffed animals and skulls in glass cases give a flavour of an old-fashioned museum, while "found" items such as broken pottery are on display behind clear glass in the floor.

A central point of the shared space is an open wooden staircase which allows staff to bring students together but also provides a space for students to gather to work in groups. This contrasts with the more traditional design of a closed school hall, closed unless students seek permission first.

Each year group has its own area, although mingling is encouraged and friendships are made across year groups in this way.

Pupils describe competition for the best workspaces between year groups as "friendly feuds".

These physical arrangements support a year-group structure designed with friendships in mind. Each year of 100 pupils is divided into six tutor groups and they have the same tutor for three years.

But when it comes to subject lessons, the classes are re-arranged every four months.

Rasmussen says: "We do this six times over the three years so they don't consider themselves as belonging to a class but belonging to a year."

Students, he says, will regularly experience different teachers, all with different styles. This, he says, maximises the chances of a pupils being taught, at least some of the time, by a teacher with a style that suits them.

The re-grouping of students within the classes is also designed to promote friendships and relationships. Rasmussen says: "Normally you have a class and you have one or two students who don't have any friends really in that class, but maybe in the next class they would find a friendship for life. "Now they

are a year unit they mingle between all 100 and find relationships."

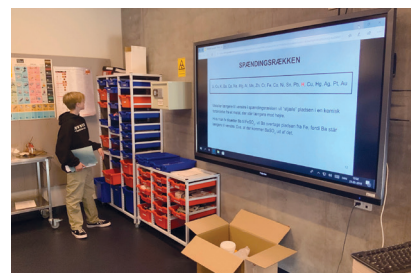
This is backed up by the students themselves who say the structure of classes and the use of space encourage a sense of community and belonging.

Year 9 student Silke says: "I've got a lot closer to the 7th and the 8th grade by just kind of being here and being able to talk."

One key feature of the new building is the impressive wooden flooring on the upper level – so impressive, in fact, that shoes cannot be worn.

Footwear is stored in a spacious cloakroom area at the entrance, with large wooden racks.

Although this was initially met with resistance from some teachers (concerned they would become "the



shoe police") most have found it has many benefits.

Shultz says: "Noise-levels have improved and the students actually don't have that many conflicts because they are not wearing shoes, they can't run in the same way, they can't be aggressive, it's more relaxed."

In spite of having large open-plan areas and high ceilings, the new building is remarkably quiet, thanks to extensive wood panelling that incorporates a high level of acoustic treatment on the walls. This warm natural look is contrasted with more stark concrete.

When working on the project – which was complete in June 2017 - leaders consulted with pupils and staff on what kind of furniture they would like to see in the new rooms.

While pupils were keen on sofas and

PLANNING LEARNING SPACES

other soft furniture, teachers were not so enthusiastic and a compromise between desks and chairs and more relaxed furnishings was found.

Round desks, installed in several rooms, turned out to be a big hit, despite some teachers fearing they would not be able to command pupils' attention as much as with traditional desks.

The new building is part of an overhaul of the whole school site.

The original school building, dating from the 1930s, was refurbished in 2010 and now houses years 0 to 6.

This original building retains the more traditional design of corridors and classrooms around a main central aula (hall), but the refurbishment has enhanced the balcony overlooking this, which now has a swelling wooden "belly" – reminiscent of the side of a vast boat.

As in the upper school building, students also work independently outside of their classrooms. Some study independently on stools, chairs and tables, while others use their laptops on the floor.

The balcony allows pupils and staff to have a bird's eye view of the large open space below. This is used both as a library and study area, but also as a performance space.

The day we visit, a rock band is practising, but pupils working on maths problems seem untroubled by the twangs and drumming rising from below.

Another key element of the school's recent evolution has been to open it up more widely to the community.

There are now impressive sports and after-school facilities, and a new music suite which allows audiences to enjoy performances in the new building too.

But this transformation of an historic single-block school into a campus open to the community has not been without its challenges for the staff involved.



Each year group has its own area, although mingling is encouraged and friendships are made across year groups.



One of the trickiest things for school leaders was convincing the teachers to support their plans for furnishing the classrooms, which now offer a range of seating options including window seats.

Shultz says she wanted to provoke a change in the culture of the school through the design of the spaces: "We deliberately made sure there isn't a table and a chair for everyone in each classroom.

"Because if there was, the teachers might not allow them to sit in the softer furniture, we wanted to push teachers out of their comfort zone."

The specialist areas, too, have been very deliberately situated and designed too. The food technology studio, for example, is smaller in its practical area than in many schools but it is directly

connected to an open food eating space.

This means it is used more extensively and promotes more student engagement around food and preparation.

In keeping with the culture of togetherness, students help each day to prepare the food that goes out to students and staff.

In the planning of the building, encouraging well-being, friendships and social interactions took centre stage.

PLANNING LEARNING SPACES

Overall, staff have been delighted with their new building and students are engaged, motivated and proud of their school as a community for learning.

And planners at Copenhagen municipality are looking to them for inspiration.

The city's population is growing at a rate of 10,000 new inhabitants a year and they predict they will need the equivalent to one new school a year to keep up with demand for places.

The council is hoping to build six new schools and expand several others in the coming years.

Mette Rose Eriksen, chief consultant on the construction team for the children and youth administration, said: *"We want to strike a balance between our pedagogical vision – we want to build the best schools – combined with economical perspective."*

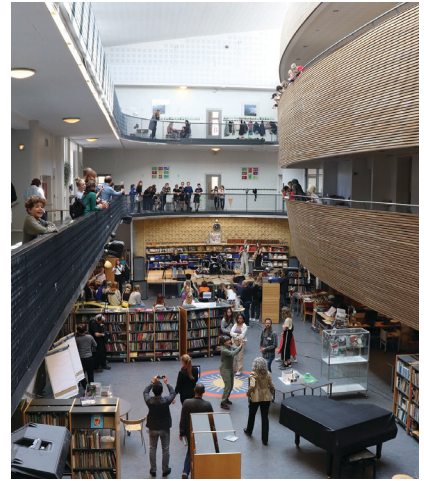
She said the municipality is working to ensure new schools are built around the UN sustainable development goals and are flexible enough to meet changing needs.

One of the key challenges though, she said, was changing the "traditional culture of how a school should be."

When we visited, this was something Katrinedals Skole has clearly already achieved.

While many schools would agree that the promotion of student relationships and independent learning are a good thing, their premises can conspire against them.

At Katrinedals, these things are built in.





Children who had to hit targets or pass exams are made to “*compete in lead boots every day*,” he says, dragged down by stuffy air, gloomy rooms and excessive noise.

Instead, he says, they should be treated like “*middle distance runners*”, where every aspect of their training was carefully considered to see if improvements could be made.

Heppell says: “I’ve been into over 60 examination rooms over the past 2.5 years and I’ve not been into one anywhere in the world that didn’t damage the kids’ prospects. Every single one of the kids could have got better marks if the room had been better, without exception.

“In quite a lot of them the kids in one corner of the room are probably doing better than kids in another corner.”

Meet the Learnometer

Professor Stephen Heppell explains the development of a new device that helps school pupils and their teachers improve their classroom environments while learning vital lessons.

Our homes are increasingly infused with internet-connected technology, designed to make life better, faster, or simply more interesting.

Smart fridges let us view our salad bins from our phones, Alexa brings us jokes over breakfast and we can control our central heating systems whilst on holiday.

But now a new device could be set to transform not our homes, but our schools and lessons.

By measuring key environmental factors in classrooms such as air quality and light levels the Learnometer aims to help schools, teachers and pupils themselves optimise their learning spaces and improve outcomes.

Its British inventors, led by the learning and technology guru Professor Stephen Heppell, say they want to see the device

across the world from the “*desks of Eton to Dagestan*”.

As well as helping individual schools improve their classrooms and exam halls, it is hoped the vast amounts of anonymised data the devices can gather will support global research into the best learning environments.

But, like any new technology, the device – which measures temperature, humidity, carbon dioxide, air pollution, light, sound levels and rhythms – has been a long time in the making.

Spark for the project

“The spark for the project was elite sport,” says Heppell, who has advised Olympic athletes on how they can achieve marginal gains in their training. *“They wanted to leave no stone unturned,”* he says.

But he realised that this philosophy had not crossed over into education.



Teamed up with friends

With all this in mind, Heppell teamed up with a group of friends with different areas of specialist expertise five years ago.

“Before we started the project we were starting to measure some of the key details of the learning space and it just seemed like a jolly good idea to put all of those measurements in one box,” says Heppell.

The team had numerous puzzles to solve to achieve this, including ensuring correct temperature measurements in an electronic gadget which naturally heats up during use.

There was also the challenge of deciding exactly what the gadget should be measuring.

Numerous pieces of research have underlined the links between low CO₂ levels, moderate temperatures, good lighting, good acoustics and improved academic performance.

And new research from China on the link between pollution and cognitive decline [bit.ly/2BRSFP5] prompted the team to ensure the Learnometer would measure the particulates in the air produced, for example, by diesel fumes and pollen.

Prototypes were eventually produced on 3D printers and Heppell and his team set about encouraging schools who were already monitoring aspects of their learning settings to try the new device.

There are now around 100 prototype boxes in use in schools, universities and even a few teenage bedrooms around the world, which have produced about 1 million hours of data.

Once Heppell and his team were happy with their initial development of the Learnometer they teamed up with British classroom furnishings company Gratnells — famous for its storage trays — in order to create and sell a commercial product worldwide.

Gratnells in turn called upon industrial designers and experts in Silicon Valley, California and South Korea to perfect the device.

A key aspect of the project is to encourage pupils themselves to use the box to investigate their own learning environments and come up with solutions. In this way, Heppell explains, the devices become a gateway to in-class activities and experiments and engage students in issues around environment, science, maths, geography and teamwork.

In one Spanish school, for example, pupils investigated how to reduce the noise in a stairwell – concluding that the best way was for people to climb the stairs on tiptoe.

In Bondi Beach in Australia children looked into how to reduce the noise in their school canteen.

“The dining room was too noisy so the kids put a meter in the dining room, they said every time the noise goes above 75 decibels we’ll double the price of the food for the rest of the lunch break. The dining room went quiet and the headteacher saved on a \$50,000 bill for soundproofing,” says Heppell.

“We think very strongly that we need to involve the children in this,” says Heppell, stressing the role of “meta cognition” in learning.



“There’s something about the children thinking about ‘how can my learning be better?’ that makes their learning better.

The key to the Learnometer, Heppell says, is that every school will use it differently.

They may be interested in improving one aspect of school life, such as pupil behaviour, exam results, or well-being, or simply curious about what aspects of their environment may be holding them back.

Schools with the Learnometer can use it to look at their own data in real time — for example it might show that CO₂ is too high and teachers can increase ventilation. If the room is too hot or dark they could try removing displays from windows, for example.

“It’s like a little game of chess really, trying to make the classroom as good as it can be,” say Heppell, underlining the paradoxical situations that can occur, for example reducing heat with air conditioning can create a distracting noise.

The data readings are also stored online so staff and pupils can analyse how they change over the course of the day or longer. They can also compare their data to anonymised aggregated data from other schools and countries.

Institutions with the Learnometer will become part of an international community, receiving regular feedback on

the activities of members in other locations.

They will also get updates on research findings and examples of interventions to allow better classroom environmental management.

Dream for the future:

Now, Heppell says he is looking forward to seeing the aggregated data that owners of the Learnometer will produce.

“We can’t wait to see what we learn from those enormous datasets, going from big data to flipping colossal data, how would we not be excited about that? How would we not want to get them out there?”

The data could be used to make improvements at individual school, classroom or policy level, he says.

Good data, he explains, enables policy makers to be precise about the best light, temperature, ventilation and noise levels, for example.

Policy guidance can also be clarified, such as asking teachers not to place paper on windows, or school designers to prioritise learning over saving energy on lighting.

But he stresses: *“One of the absolute guarantees we give schools going forward is absolute anonymity. Nobody’s going to phone you up and say ‘I’d like to sell you new lights for your school because I see it’s too dark.’”*

One important thing to investigate will be the interplay of different variables in the learning environment.

Heppell says: *“For example if a room is ‘too warm for learning’ and perhaps soporific as a result, is the impact of CO₂ greater, or sooner than would otherwise be the case?”*

“Or in a country where it is really hard (or expensive) to drop temperatures down, where might the best efforts otherwise be directed to optimise the learning spaces despite that heat?”

He also wants to look at the possible impact of climate change, especially on exam performance: are we, for example, holding exam season at the wrong time of year?

Hard facts and data will help governments, schools, teachers and pupils make better decisions, he says.

Ultimately, Heppell believes all this data and appropriate reactions to it will result in “better learning”.

“My entire life has been about that. I want smarter kids coming out of schools,” he says.

Short and Sweet

Why quality, not quantity, is what counts in the collaborative school design process.

It is a common misconception that good collaboration and consultation in the school design process can take up too much time and money.

There are, therefore, many examples of inappropriately designed schools where all stakeholders working together has not been a priority.

But the Association for Learning Environments (A4LE) stresses that collaboration and consultation are key to good school design and it wants to bust the myth that they are costly or slow down the design process.

To prove this, the association teamed up with the School of Architecture and Cities at the University of Westminster, bringing together five multi-disciplinary teams to respond to a design challenge set by two head teachers.

The teams were given just one day to create learning environments in schools that focused on developing the skills children are expected to need in the future. These include the ability to collaborate and use interpersonal, social and emotional skills.

The teams involved in the challenge included groups of teachers, architects, students, policy advisors and government representatives.

They were set two briefs — one for secondary and one for primary — drawn up by Dave Strudwick, director of Way American Online School and Gary Spracklen, headteacher of the Prince of Wales School in Dorchester, UK.

Care was taken to ensure the design teams included representatives from all possible perspectives, including the educational, design and technical sides (such as acousticians).

“What we wanted to do was demonstrate that with a well-defined learning brief,

Although students and teachers have an important role to play in the challenge to design more effective learning spaces they often feel unheard.



effective dialogue with headteachers and good multidisciplinary teams, innovative and cost effective future-focused designs can be developed within a day,” says Terry White, chair of A4LE.

He stresses that the key to success is not the quantity, but the quality of the time spent together. A well-managed process with clear goals is key to producing a design that is far from a “one-size-fits-all” solution he adds.

Through an intensive and collaborative process, the teams came up with a range of ideas that were discussed and tested against the brief and the current baseline building requirements.

They were able to set their ideas in the context of the wider school campus and consider the wider learning, curriculum and organisational trends for schools in the future.

The primary school design challenge Two teams were charged with



developing a new build primary school learning zone for 60 Year 3 students and 60 Year 4 students. Spaces had to support staff working more collaboratively in learning teams.

The designs had to ensure that children felt well-known and supported by staff and their learning was personalised.

The spaces also had to enable staff to bring different sized groups together and support an enquiry and project-based approach.

The first team, facilitated by Jonathan Nicholls of Hayhurst and Co. architects, developed a “manifesto for learning” as



By starting with the use of models, the team established a common language that everyone could understand.

the basis for their design. They wanted to create spaces that would allow a collaborative teaching approach and could be used flexibly to support different learning practices.

They also wanted the spaces to be enjoyable, and include outdoor spaces that appealed to pupils and form a good backdrop for learning.

Through discussions, their design moved away from the typical division of spaces into cellular units to create more open-plan spaces.

The second team was facilitated by Lene Jensby Lang of Autens consultancy in Denmark and Mark Clarke of the Chadwick Dryer Clarke Studio.

They started by using a physical model as a response to the brief. The spaces were swiftly and intuitively modelled and 1:20 scale furniture was added.

The process triggered the team to structure the design by the learning

activity and function needed in the spaces rather than by how the pupils are grouped.

The design developed as a landscape of connected learning spaces, with active making spaces and areas for physical exertion linking to areas for group discussion and presentation. These led to quieter zones for individual study or reflection.

By starting with the use of models, the team established a common language that everyone — including teachers and pupils — could use to discuss ideas without the constraints of jargon or the esoteric language of architectural plans.

The secondary school design challenge:

The three secondary design teams had to design a transitional learning zone for the first two years of secondary education (Years 7/8 in the UK).

The first team, facilitated by Lyle Christie from Reiach and Hall, imagined a future where learning was divided between the virtual and the physical worlds. Much of the time, pupils would receive personalised lessons over the internet from avatar teachers.

Learning in the physical school would focus around practical activities such as science experiments, cookery, developing real-world social skills and community activities.

The team developed a new kind of school where learning is not segregated into closed cell classrooms. An open programme would encourage students to mix outside of the rigid structure of the year group or registration class.

A forum space for the school and the wider community was placed at the heart of the plan. From this space every room could be seen and accessed.

Immediately addressing the forum at the ground floor was the school kitchen, placing communal dining as central to driving a sense of community spirit throughout the school.

A second team facilitated by Tom Lyons of GSS Architecture developed a “hub and spoke concept” to meet the demands of the learning brief.

Individual learning “core” spaces were arranged around a central larger studio space allowing a full range of group sizes and activities to be created.

The core spaces had a range of small spaces leading off them suitable for a variety of learning activities. They were also linked to the outside space, allowing an ease of movement through to the main secondary building.

A third team facilitated by Ian Taylor of FCB Studios argued that the school masterplan and form should demonstrate how the school links into the community and geographical context.

Imagining a site, the school masterplan reached out into the town centre and surrounding landscape with some teaching taking place there. The spaces in the school poke out and engage with the town and surrounding area.

No one-size-fits-all approach

An important message from the workshop was that a one-size fits all approach will not meet the learning and teaching needs for “future focused” schools, and that to create and design learning environments they need to be designed “inside out”.

To do this it is essential to have:

- A well-defined brief
- Quality of time and preparation
- Good intelligence
- Good collaboration

The ideas from the workshop are being made available by A4LE UK in order to develop the school design conversation with the Department for Education and for schools and designers to take forwards on real projects.

Planning Learning Spaces

A Practical Guide for Architects, Designers and School Leaders

Murray Hudson and Terry White

Planning Learning Spaces by Murray Hudson and Terry White, published by Laurence King in October 2019, showcases contemporary thinking behind the design of educational spaces that maximise learning and prepare children for life in our evolving world.

The authors prompt readers to question common assumptions about how schools should look and how children should be educated: Why, they ask, have so many schools changed relatively little in more than a century? What form should a school library take in the internet age? Do classrooms really have to be square?



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