

Spatial awareness: reimagining new spaces for learning

By shaping the system to the student, giving up control in favour of innovation and enthusiasm, it is possible to recreate new and more successful spaces for learning. **Sean McDougall** looks back to the Victorians, and then takes us on a trip around the globe to reveal insights into how to make school somewhere that students really want to be, using case examples of stakeholder engagement with design to illustrate.

Since the time of my great-grandfather, we have seen the rise and fall of the agrarian society, industrial revolution, the rise of the service economy and now the emergence of the global knowledge economy. Each and every day we do as much trade as we did in the whole of 1950 and as much scientific research as in 1960. Yet when we look at the basic operational premise of schools, it appears that nothing much has changed. If we take something as simple as the seats on which students sit, it could be argued that things are actually worse than before.

Classrooms as spaces for indoctrination

The earliest photographs of British classrooms show that education is effectively based on a mid-Victorian church service. As can be seen from the photograph below right, the classroom itself resembles a place of worship, with a large arched door, a high ceiling and a pulpit. This format was chosen because it is uniquely well suited to mass indoctrination into a single way of thinking. Having dressed up for the occasion, pupils would come into the room and sit silently in rows, facing the front, just like a congregation. They would perform their tasks simultaneously, doing the same thing at the same time and in the same way as everyone else. The teacher, mimicking the parish priest, would then deliver a 'lesson'.

The Victorians were very clever in this approach to education. Not only did they choose a format that most people already recognised (a church service), but they thought holistically about the needs of the pupils and the wider society in which they lived. Schools closed at Easter and in summer so pupils could help with planting and harvesting. As the agrarian economy gave way to the challenge of industry, pupils would have been glad of a place at school, their lives otherwise full of drudgery and effort. Here they could learn about strange places and acquire skills that would see them safely through life. Whether destined to be a welder, soldier, missionary or civil servant, schools were a good training ground. Each of these occupations is based on apprenticeship, hierarchy and obedience. Students wore 'uniform', sat in 'class' and were 'schooled'. The output was generation on generation of obedient specialists, primed to do the same thing over and over again, all day.

Are we sitting comfortably?

Unlike today's schools, which are full of furniture bought solely on grounds of cost, Victorian furniture was designed to assist the learner in their important task. As can be seen from the photograph right, the

typical classroom featured furniture with sloping desks and a raised seating position that protected the spine and helped to sustain alertness. Students using this furniture would have been encouraged to adopt a healthy sitting position, with a 60-degree bend at the waist and weight shared between spine, thighs and forearms. This position allowed their lungs to open and conserved energy that could be used, instead, for learning. When reading, they would have found that the angle of the desk accorded with the natural reading angle of the eye.

Victorian furniture, fixtures and equipment was generally much more sustainable than today's. Blackboards and slates, while reinforcing the idea of apprenticeship and imitation, were inherently long lasting and reusable; the seats were of a quality that puts most contemporary school furniture to shame.

Today's short-lifespan school furniture is made of petroleum-based plastic and is designed entirely around cost. Ergonomic advice ignores the fact that there is no animal on earth that chooses to sit with a right-angled bend at the knee and another at the hip. However, chairs designed in this way are cheap to make, stack together to reduce transport costs and can be put on top of desks at the end of the day to reduce cleaning time.

The photograph at the top of page 11 shows the impact of this on posture. The cumulative effect of using contemporary school furniture is a sore back, compressed lungs – reducing oxygen intake as shoulders hunch forwards – neck pain from suspending the head forward of the body and a reduced ability to concentrate.

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Victorian classroom



Modern-day school furniture's negative effect on posture



The cumulative effect of using contemporary school furniture is a reduced ability to concentrate

Going forwards by going backwards

While leading a campaign for the UK Design Council, I was lucky enough to come into contact with Anthony Hill of Stage Systems and the staff and students of St Margaret's High School in Liverpool. Together, we developed a new desk-chair combination called the Q-Pod. The photograph right shows a pupil sitting on it and it should be immediately obvious that his posture is significantly better than that of the students on plastic seats in the photograph above. The key to development was a principle called co-design, in which change is engendered by combining, non-sequentially, the expertise of multiple specialists and, most importantly, end users. It mirrors thinking strategies of the pre-industrial era and is proving to be an excellent post-industrial model as well. For more details on how this can then be used as a central part of a more flexible learning space, see the box on page 12.

Starting again

As the very phrase Building Schools for the Future implies, we have stopped seeing school as a way of learning and started to see it solely as a place of learning. In effect, we have a product-led view of schools rather than a service-led one. We also have a visual, looks-led, concept of schools that resembles the architects' view from outside rather than the students' view from within. We need to re-engage with schools as a collection of tools and services, each of which can be redesigned to improve educational outcomes. As we do so, we need to copy the approach of the Victorians by designing for a time that lies ahead, rather than one that has passed away.

School used to provide a welcome respite from the drudgery of hard manual labour but, today, school is seen as a chore. Part of the disincentive of school is that it has all the hallmarks of a bygone era, raising

Case example: robotic learning

Rulang Primary School's robotics centre looks like a design studio, full of bits of machinery that you can put together using child-centred software called *Lego Mindstorms* (see: <http://mindstorms.lego.com> for details). I was privileged to watch these pupils as they addressed a year-long problem that developed key problem-solving and communication skills using a medium and a subject that they found interesting. Here is the problem:

Singapore is home to the world's second largest oil refinery business. Terrorists have planted bombs on the refineries. One of them has gone off and, as a consequence of this, oil is now leaking into the sea. As there are other bombs, the refinery is off limits to humans. Please conceive of, design and build some robots capable of finding their way around the refinery. They must be able to identify the bomb by feeling for it, then defuse it. They must also be able to jump into the sea and clean up all the oil. As everyone in Singapore is worried about the bombs, please create a website keeping people up to date with your progress. We know that the process of innovation is likely to result in new software code or new ideas for products, so please also put together a business plan to sell everything you develop.

The pupils completing this exercise are seven and eight years old. Watching them, it is obvious that they are totally engaged in the lesson. They collaborate, they communicate, but most interesting may be the way that they learn multiple subjects simultaneously. Additionally, soft skills that will help them to gain employment in later life – working with others, teamwork, collaboration, integrity, work ethic, application, a sense of personal confidence in your own ideas – are naturally present in the project.

questions about why we persist with the model. Perhaps it is because the early Victorians were 'pre-model' in their thinking, free to pick and choose a place, structure, timetable, curriculum and age range. Today's educationalists are 'post-model' but they are not prisoners of it: it is only convention that prevents us from thinking as freely as the Victorians. Our mission as educationalists and as designers is to put the delight back into going to school. How can we make school so interesting that it does not have to be compulsory?

It is said that, in the 1950s, the chairman of IBM said he thought that we would probably only need five computers – maybe one on each continent, dishing out information to grateful nations. However, processing power was democratised and now the ratio of computers to people in the UK is approaching 1:1. British educationalists are free to make a similar shift, as IBM did in the 1980s. Do we still need our schools to resemble the 1950s' supercomputer – self-contained, centralist, ultra-

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powerful and physical? Or could we develop a new 'laptop' model – portable, specialised and transitional? Could we, as teachers, facilitate the move from once-in-a-lifetime change to multi-purpose, short-lifespan, purpose-led networks? If school perpetuates itself, unchanged within a changing society, much as the Church has done, will there not be similar consequences?

Many teachers will balk at these ideas, but every idea mentioned in this article is already in practice in other countries that are also concerned about their students' ability to survive in a global economy. The question is not whether it can be done; it is more about which elements from previous pedagogies should be taken forward and which need to be replaced. Where replacement is needed, the question is how?

The reason we have to do it is because, at present, 80% of young people who are black leave school at the age of 16. By 2012, the year of the Olympics, half

New positions for learning

Seats that improve learning

When we designed this seat, the focus was on making the task of learning easier, not cheaper. Designers sat with students to see lessons from their point of view. Students outlined the many ways that lessons could be improved – varying the task more often, allowing for debate and collaboration, supporting movement, embracing a new type of technology and looking after their posture. They then participated in the development (not just use) of a solution based on their stated needs.

The outcome in this case was a 360-degree flexible classroom in which furniture supported a vast increase in the number of teaching and learning options. Q-Pod furniture, which is height adjustable, supports all standard learning tasks but has a significantly reduced footprint, releasing floor space that we used to create a pathway around the outside of the classroom. This pathway allowed the teacher to reach every student in the classroom and to use all four walls as writing or projection surfaces. In our experiment, we noticed that, as the teacher moved around the room, students instinctively swivelled round on the seat to follow the lesson. Removable whiteboards on the walls were brought down on to tables to support collaborative learning and debate, before being displayed immediately for the whole class to see.

Removing teacher's desk as throne of authority

One interesting aspect of the experiment was that the teacher's desk was removed in order to give the other teaching walls legitimacy. Teachers found this unsettling, but it was an essential part of a process that saw them move beyond a 'command and control' philosophy and become facilitators, as well as leaders, of learning. Many teachers, introduced to this idea, experience feelings of panic. However, the idea, now tested, has shown the value of this practice when used in addition to other, more traditional, approaches. It is essential that teachers are given an opportunity to grow into the role and that students have time to become used to the idea.

Flexible learning spaces

One of the best lessons I saw taught in this style of classroom was PE. The teacher began by explaining that the lesson would focus on heart rates in athletes. Soon, a sprinter and a swimmer were walking and jogging round the pathway wearing heart-rate monitors. Their recovery rates were calculated and the difference noted (the sprinter recovered quicker but tired sooner). Next, two of the removable whiteboards were brought into the middle of the room; they became valves within the heart, with students opening and closing them to show the one-way nature of blood flow. By involving the pupils in the lesson, varying the task at hand, and responding to their needs for movement and dialogue, this teacher created a lesson that was truly engaging. Students effectively forgot that they were in a classroom and participating in the activities helped to reinforce their learning.

The furniture used in the flexible classroom allowed pupils to disperse nervous energy by swivelling on the seat; the production model also allows them to adjust the height in seconds to suit their particular size (there is a vast range of sizes between Year 7 and Year 11 – and even the range within the Year 7 cohort is huge). This seat is not born of a desire to save money; but it does challenge the idea that 21st century learning should be vested in hugely expensive buildings filled with cheap plastic furniture. The price of the Q-Pod is dependent on the quantity ordered. For more details and to find out how to purchase the Q-Pod, go to: www.qlearn.co.uk/site/scripts/module.php?webSubSectionID=21

Q-Pod by Stage Systems



Case example: stakeholder design

Taking the example of musical fountains, I asked what would happen if you were to equip a musical fountain with stereo microphones so that it could hear what was going on and it had motion detectors so it could see people as they were passing by? What if you hooked that up to a computer and invited pupils to select how the fountain would respond in certain situations and contexts? What if you located the whole project in a primary school rather than entrusting it to sixth formers?

I was delighted when the idea was selected out of several hundred put forward. Following a successful interview, we are presently developing it with staff and students of Luckwell Primary School in Bristol, using a stakeholder design process. The project is due to be completed in the summer of 2007.

The fountain has the potential to act as a speed camera: imagine students running by the fountain only to see it dwindle to a trickle; they start walking again and it returns to full flow. It could make a great partner in an end of term performance, joining in with the chorus by rising up in line with the volume level, and thanking the audience for their applause by making a spray effect. The pupils might even use it as a voting device with the different columns showing how popular different thoughts are.

So far, our work has delivered collaborative learning, multi-age-group learning, cross-curriculum learning and a vast increase in focus. The problem-solving capacity, not only of the students, but also of the teachers, is improving. They are experiencing something that is symbolic of the new pedagogy, something that can be reconfigured and changed in response to the needs of each generation of young people. Reconfiguring the fountain will remind them to have a look at the school's systems and practices to see if they need to be changed as well. The students' confidence will grow because they own a slice of the school instead of just having to be there.

At this point, the fountain is an object that justifies the science lesson, the drama lesson and the English lesson at the same time. Most importantly, it provides for collaborative, multi-subject learning based on things that pupils are interested in. I set it against the proposed new Northern Ireland primary curriculum and was pleasantly surprised to see that almost every aspect of learning could safely be delivered through the fountain medium.

of all the jobs that are advertised in London will require a degree. So, we are automatically and inevitably, within one seven-year school cycle, potentially facing an apartheid system in terms of employment, whereby management will effectively become closed to black people.

Shape system around pupil

It is no answer to force students to endure a system set up for white, Christian Victorians. It is likely that disaffection is growing and spreading across the student population. Rather than asking ourselves how we can make disaffected students to come to school, we should perhaps be asking how we can make school appealing to them.

It is commonly argued that barriers at work (for instance, the 'glass ceiling') show that the system benefits some people more than others. It could also be argued that, if intelligence is sprinkled equally across the population, the success of one part of the population indicates that school suits them more than other sections. Our task is to broaden the functionality and appeal of schools so that they (or an alternative educational model) can improve outcomes for every section of society.

Change is more likely to work if end users are involved in creating or managing the solution. At the Design Council, we pioneered a co-design approach for education by developing a prototype online tool called Designmyschool, a website providing practical tools, ideas and resources to enable students, teachers and parents to participate in designing their school. The original version, produced by adults for use by young people, was word heavy, compulsory, linear and boring, decorated with an image of a young Asian girl looking interested. With the support of the Specialist Schools and Academies Trust (SSAT), we took Designmyschool to students at 20 schools. We worked with them while they decided which questions they would like to be asked about

schools, how they would like the site to work, what images and text it should contain, and what additional services it should provide.

The resultant prototype, funky and youthful, was then tested at 400 schools across England, with changes being made until the supply of comment dried up. This indicated that the tool was probably now meeting needs. The DfES is presently considering whether to develop a new version for distribution to all schools.

Computer games are developed using a similar approach. A rough model of the game is released on to the internet and thousands of programmers then set about adding and subtracting elements from the game. Perhaps it needs additional characters, or maybe you need extra stamina to complete a particular level. Eventually, the owners notice that the supply of requests for change has dwindled, while the number of users has increased. At this point the game is launched on the open market. *Microsoft Office 2007* was also developed in this way.

That being the case, is it possible that we could do the same with our approach to schools? Could we offer basic tools and assembly materials (for systems, places and experiences) to consumers of the educational service and work with them to invent something better?

Making schools different

It may be said that the current symbol of learning in the 21st century is the atrium. As with other parts of these new schools, they are rigid and dry, inflexible and difficult to reconfigure. They are also specified on behalf of the students. I wanted to know what would happen if we allowed the pupils to create part of the school by themselves. So, I entered a competition organised by Futurelab, the renowned education technology think tank. Details of what followed are in the case example in the box above.

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being overtaken by the other economies in their area, they are doing the best they can to prepare their students for a rapidly changing, highly competitive world based on inventiveness. One element that they are exploring is the idea of using robots to capture students' attention. Details of what this involves are in the case example in the box at the bottom of page 11.

Losing control

Despite Singapore's reputation for authoritarianism, some designs for western schools betray an obsession with control. Many of the features that are lauded within the educational community – glass-sided classrooms, viewing decks and the like – are intended to increase the teacher's ability to see, and so squash, particular forms of behaviour. By increasing control, one can reduce the visibility – but not presence – of dissent. There are better ways of obtaining cooperation; modernising practice, as well as place, is one of them.

In some schools, control over student behaviour has been associated with an increase in the pass rate, but there has been little research to see what impact it is having on them as people. I went to one of the schools listed in the Organisation for Economic Cooperation and Development (OECD) catalogue of excellent schools and was struck at how easily it could have been reconfigured as a prison. All of the elements were the same: an open courtyard, gangways (complete with security gates at 20 metres intervals), observation points and fences – even the classrooms were just a few bunk-beds away from being large prison cells.

I asked if I could speak to some of the students and was not surprised when the head boy and head girl were presented (that apprenticeship thing again). Both did very well at answering the simple questions such as 'how many students are there at this school?' and 'do you like it?' Yet both struggled to answer open questions: they kept looking for evidence that they were giving the 'right' answer. In America, they are starting to make comparisons between this control-heavy environment and the world of pet owners. Like a dog that simply follows orders in order to earn a biscuit, they had become expert at finding out what 'good' looked like without necessarily caring why. They had learned not to do anything unless they were told to do it and, in this school, they had become exalted as head boy and head girl.

Removing boundaries

Discovery One, a primary school in Christchurch, New Zealand, is the only school I have ever been in that features graffiti by the Education Secretary. 'Children are different,' it says, 'so why can't schools be different?' Discovery One certainly stands out – at this primary school, pupils put together their own timetables and multi-age, multi-subject learning is the norm. Across the road stands Unlimited, a secondary school born of parental frustration and located (for now) on the top floor of a shopping centre in the central business district.

Unlimited demonstrates the extent to which learning opportunities in British schools are constrained by boundaries of place, time, age, methods and areas of study. There, the entire community is a learning environment. Students use the public library, the parks, the leisure centre and

the shops, rather than having all of these replicated within the walls of a cloistered community. Unlimited's students direct their own learning, aligning interests with curriculum and qualification needs. So, if the topic of the moment is conflict, one student may research the Maori Wars, while another looks at Gallipoli and a third studies Iraq. Teachers report that it is no more difficult than keeping an entire class focused on a subject that appeals only to some of them and that it makes for really interesting debates, during which students gain fresh insights into the subject from a range of perspectives.

Pupils at Unlimited are not constrained by age from reaching their full potential. One of their students runs a logo design agency with clients in Europe and the United States. Like any adult, he has been exempted from certain modules of his business studies course where he has already proved competency. With the support of his teachers, he is using the time saved to take a course at university. Faced with such wonderful, user-centred, flexible support, it makes you wonder if there is any reason why we persist with the idea of 30 pupils of the same age doing the same thing in the same way at the same time and for the same length of time.

Unlimited combines innovative pedagogy with a genuinely sustainable approach to the built environment. Instead of putting millions into destruction of buildings and construction of new ones (all in the name of sustainability), they use a grant equivalent to the annual rates and maintenance cost to rent suitable empty spaces for reconfiguration as learning environments. Architects have shown how easy it is to turn factories into flats; designers love working in old warehouses; it is just as easy to turn the top floor of an office block or a shopping centre into a place of learning.

Out of the valley of death

Herman D'Hooge, an innovation strategist at Intel, once said: 'Successful products create their own "valley of death" and prevent innovation around them.' It is difficult, faced with ubiquity, to think of alternatives rather than enhancements. For centuries, music was a public art form. The invention of the gramophone changed all that, but it was only when a dreamer at Sony asked why we had to stay in one place when we listen to music that the Walkman was born. We are now separated by two centuries from the people who invented our school system. In that time, school (and schooling) has shaped our perceptions of how learning happens, to the point where it is almost impossible to imagine an alternative.

In this article, we have looked at some fragile, new-born and dreamlike alternatives to convention. Furniture that is designed for long-term use by students and is focused on educational utility rather than cost has multiple benefits, but it is primarily a challenge to processes that put all the money into the building. Is there a single person out there who would swap their office seat for a plastic chair and not expect to see their performance levels drop? What potential is there in your school to improve educational outcomes by giving students rather than teachers the tools that they need? Is there a straight-line return between cost of product and educational return or could a chair deliver more benefit than a laptop?

Pioneering new approaches to learning

As the flexible classroom project shows, there are power relationships in classrooms that are based on control. If you are able to, consider replacing the furniture in one classroom with ergonomic, space efficient furniture that creates the opportunity to move around (you can always use the old furniture as spares for use in other classrooms).

Alternatively, why not begin the lesson in one classroom and then move outdoors or to the sports hall for the rest of it? The object here is to encourage noise, so long as it is the noise of pupils talking to each other about something educational. Unlimited has pioneered this approach with such success that it now has quiet zones instead of noisy ones. Last year, its students achieved top marks in New Zealand for three subjects and the school was rated 'outstanding' by the New Zealand equivalent of Ofsted.

Robots, fountains and computer games link to new pedagogies, created in response to students' interests and in pursuit of both hard knowledge (facts needed to pass exams) and soft knowledge (skills needed to survive in society and the workplace). Perhaps your school is not yet ready to embark on multi-age collaborative learning but perhaps you could get pupils thinking in different languages by asking them to reset the language on their computer games to Spanish. *Lego Mindstorms*, which is available for less than £200, could transform your attitude to learning and problem-solving, especially if the same principles were then applied to, say, a physics question. I saw a one-metre cube sitting in a playground once. It would be fascinating to watch students figure out how it got there, if a teacher announced that it contained heat-insulating aerogels, found mostly on Mars.

As with most environments, the pioneers who succeed in the 21st century will be those who

combine sound practical knowledge of the basics with willingness to learn and adapt. In 1851, Britain ceased to be a rural country. By 2012, we will have ceased to be a rural planet. As our young people grow up, they will access and discard ways of working, perhaps as often as every couple of years. They need to see teachers doing the same thing. For some tips on starting to reconfigure the learning environment, see the box below.

By 2012, as outlined earlier, half of all jobs in London will require a degree. All over the country, physics departments are closing due to a shortage of students interested in this most amazing of subjects. The DfES-sponsored Project Faraday (of which I am part) aims to develop really interesting science experiences with a view to persuading students that it is the method and not the subject that has bored them in the past. Teams of leading designers and educationalists with expertise in science teaching will develop a range of exemplar designs for school science laboratories by mid-2007. Science demonstration projects will then be built to provide practical examples, to act as benchmarks and to disseminate the learning. The project will be evaluated over a number of years. Stakeholder engagement is the means by which we aim to understand, and then respond, to their needs.

Rather than shape the pupil to the system, we need to consider how we might shape the system to the pupil. The consequences, for the pupil and for the system, if we do otherwise do not bear thinking about.

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Top tips for reconfiguring learning environments

- Understand the difference between teaching and learning. Which is your room set up for?
- Count how many ways the classroom supports different teaching and learning styles. Chalk and talk? Yes. Gather round while I show you? No. Use this to improve your understanding of how the space helps and hinders you.
- Studies have shown that 83% of the entire contents of a classroom can be moved. Do not be afraid to experiment; just removing display materials can help you to understand which materials are helping students and which are distracting them.
- If furniture is literally getting in the way of your efforts to support students, think about getting rid of it. Sixth-form students love soft furnishings; younger students can work well on Q-Pods and tablet seats. If you buy a class set, the old furniture can be used as spares across the whole school, helping to fund the change.
- Simply moving the lesson outside can free up the space you need for proper interaction and collaborative problem-solving.
- Think about the technology and working methods that young people use outside school. Is there any reason why it should be banned in school? Just two years ago, iPods were viewed with great hostility in many schools; now they are seen as a great way to promote language learning and catch up with missed lessons.

Thinking creatively

- Do not let a sense of everyone doing the same thing in the same way prevent you from innovating. Best practice becomes same practice when everyone is doing it. Next practice has to be different.
- One of the most important elements of innovation is the creative leap. This is most likely to happen through juxtaposition. So, if you want to innovate in your school, make sure to go somewhere that is not a school and use it for inspiration. For instance, see how many ways you can think of in which your school resembles Carphone Warehouse? What would happen if Carphone Warehouse was asked to run all our schools?
- Ask your students for help.
- Do not let learned scepticism get in the way. Innovation is hopeful, not shallow. You need to persist with ideas and ask how they could be made to work rather than listing reasons why they will not.
- Be clever enough to involve experts, and do so from the start, in the knowledge that it will save money and improve outcomes. Companies that involve designers at the planning and strategic stage have outperformed the FTSE 100 by 250% over the last 10 years. Schools can achieve similar improvements.

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