

# The science behind the perfect lab for learning



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## WHEN IT COMES TO RENOVATING SCIENCE LABS, IT'S VITAL TO GET IT RIGHT

With pressure to make every penny count on every school renovation project, Melanie Laing, director, Innova Design Group provides a guide to creating the perfect lab for learning.



Despite the government placing a huge emphasis on STEM subjects, recession-era slashes to school capital funding have seriously impacted progress and huge gaps still exist in the quality of UK secondary science labs.

While capital funding is on the increase under the Spending Review 2015, budgets have a long way to stretch and there is a need to ensure funds are spent as effectively as possible, with no money wasted on ineffective solutions.

To find out about the size and nature of these gaps, the team at Innova recently conducted a survey of the sector and found labs to be overwhelmingly unsuitable, low tech and unfit to inspire.

In light of this, and having deconstructed the ingredients of the perfect science lab for our survey, I have compiled a guide containing the essential ingredients for creating the very best scientific learning environment to help educators, specifiers and designers.

Indeed, the worrying fact that **85%** of respondents indicated facilities don't bring out the best in themselves or their pupils wasn't even the most concerning – that would be the astonishing **49.5%** of teaching professionals that reported they were not confident about pupil safety in science lessons.

Symptomatic of the wider problem, the study also revealed that 63% of education professionals view science labs as low tech.

“  
*Every potential problem from storage to technology and safety has been mitigated through design while practicals are now more engaging and rewarding.*  
”

*Joe Burchell, Student at Solihull College*





“ Against a background of standardization and austerity, this new school shows how – with the support of a considered client – high-quality, bespoke design can still be delivered through effective consultation with end users – and within public sector budget constraints. ”

Amir Ramezani  
Director of Avanti Architects

“ It is lovely to see the children working in a building which is beautifully designed and allows for different types of learning. ”

HRH Duke of Gloucester



# 1. Give teachers and pupils a sense of ownership

**Classrooms should be designed to optimise teaching and learning and create an environment within which pupil and teacher interaction is easily facilitated.**

When it comes to teaching and learning, practical subjects require practical spaces that let staff and students get hands on – whether it's carrying out experiments in science or making new discoveries in engineering.

Teachers often adjust their teaching style to suit their learning space, so the opportunity to work in a classroom refurbished or built to meet their specific needs can be a transformative experience.

Here we speak to teachers whose classrooms have undergone renovations by Innova Design Group who inform us how their refurbishments have changed their approach to teaching and delivered an impact that goes way beyond the 'wow' factor.

"If someone had told me the difference refurbishing a science lab would make to my teaching and to students' learning, I'd never have believed them," says Hardeep Mattu, Key Stage 4 Coordinator at Shireland Collegiate Academy in Smethwick.

"In our old science lab the tables were really cramped together. It was difficult to get round to all the students and difficult for them to move round to carry out practicals or group discussions."

"Changing the layout to dual function benching with one side for theory and the other for practical study has given us much more space to circulate and means all the students are seated so they can see and hear me when I teach – and I can see

and hear them!"

Paul Fowler, electronics tutor and programme leader at Vision West College in Nottinghamshire agrees: "Changing the layout to increase space and improve circulation has given us a much more flexible learning space."

"In our old classroom the tables were laid out so pupils sat behind each other in rows, it was hard for those at the back to see and hear what was being taught."

"Switching to dual function benching means I can see the students and quickly spot who's struggling. The improved circulation means I can then easily get round the classroom to help them, so no one falls behind."

Changing the learning environment doesn't just give you a fresh, modern interior to work in, according to Hardeep: "The biggest difference is in attitude: the new lab makes students want to study science – they really look forward to practicals and some have even told me the improvement in facilities helped them make the decision to study science subjects when they moved from GCSE to A Level.

"Not only do the students feel more confident in their ability to carry out practicals, we as teachers have more confidence in planning and coordinating practical work, knowing we've got the facilities to achieve what we want to in a space that really works for us and inspires us."



**Before, we were all sat in rows and it was very traditional. We could do experiments, but working in groups and collaborating on projects was a bit more difficult.**

Now you can move the desks round, you can reconfigure the classroom to the teacher's needs for that lesson, which you couldn't do with the old ones, so it will completely change the way teachers plan their lessons. We'll be much more involved with each other and working together, which I think is a really good style of teaching.

*Jamie Edwards, Student, Penwortham Priory Academy*



## 2. Ventilation

According to Salford University's Clever Classrooms report 2015, quality air has a major impact on a person's ability to concentrate and process information and the ventilation within a classroom has been shown to have a major impact on a child's learning process.

Additionally, evidence indicates that poor air quality is rather a common problem in UK schools.

In no area of schooling is quality ventilation more essential than science as it protects everyone who uses the space from short-term exposure to toxic substances.

Identifying the best ventilation systems can be complex and often over-whelming. Concerns like indoor air-quality, energy efficiency and sustainability are of prime importance and underwritten by legislation, regulations in educational new build and refurbishments.



### Checklist

- Big window opening sizes, at different levels can increase the air exchange rate and also provide ventilation
- Where possible, increasing the ceiling height can improve the air quality of the classroom
- Mechanical ventilation to introduce fresh air may sometimes become necessary when window openings are not available.

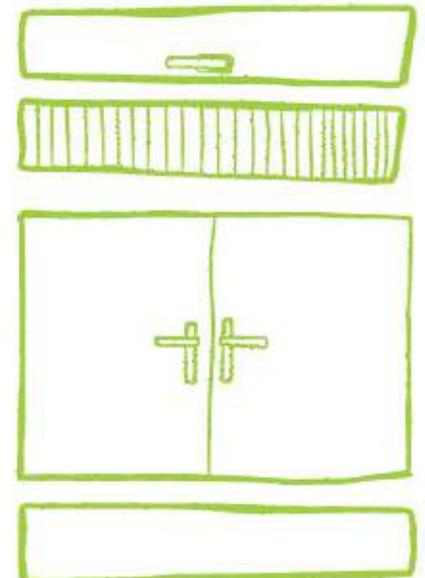
Source: Salford University, Clever Classrooms Report, 2015 Report

small, high-level windows, which allow small amounts of ventilation in high wind;

trickle ventilators for cold weather, high winds and when other windows are closed for security;

large, main central windows for still, hot, summer weather;

small windows at bench height for all-round ventilation – may have to be closed in high winds to prevent papers flying.



### 3. Natural Light

**Contrary to historic school design worries that pupils would while away the hours staring out of the window – students exposed to more daylight in classrooms achieve better results, beyond expectation. Right first time every time.**

In a 1999 report, Heschong Mahone Group in the USA found that classrooms with the most amount of daylighting had a 20 per cent faster learning rate in maths and a 26 per cent faster learning rate in reading during one school year when compared to classrooms with the least amount of daylight.

Natural light, supported by good quality artificial lighting (LED's) can help to improve learning in all subject areas and helps to raise attainment in students. As such, it is a key ingredient of the perfect science lab.

In terms of maximising natural light in a classroom or science lab design, orientation is critical.

North facing windows tend to produce uniform light levels throughout the day. Those facing east and west can receive abundant daylight with low risk of glare during school hours. South facing windows, however, can require shading or solar film to control the degree of light.



## 4. Shortened Lines of Communication



### Consider the space

Cast your minds back to your own days in the classroom or science lab and I'm sure you'll remember that any misbehaving was done at the back – the time served hiding place of the unruly.

Shortened lines of communication are a simple factor that can revolutionise performance.

And they are easily achieved. Taking the layout of traditional classrooms, and positioning the teacher on the long wall rather than the short wall, it is possible to create a shallow room with long rows of desks, benches or workstations.

Incorporated into a science lab, it means no pupil is ever too far away from the teacher helping to improve everything from behaviour and concentration to attainment.





## 6. Health & Safety

**All laboratories need gas, water and electricity – but each of these services comes with its own set of issues making easily accessed shut off valves absolutely vital.**

In the case of the electricity supply an RCD should be fitted as it can double as an isolation switch. With gas, a mechanical or solenoid shut off valve is required to ensure capability of being turned off easily if there is a leak or drop in pressure.

Fume cupboards that evacuate harmful fumes, vapours or gases when students or teachers are conducting experiments are also vital. However they soon become ineffective, if not used correctly or regularly maintained so specifiers should set aside time to research models to ensure a lab that stands the test of time.

Limited or constricted access is one of the biggest hazards in school science labs.

The layout of the laboratory should enable teachers and pupils to move around the room while minimising the potential for accidents – particularly essential when pupils are conducting experiments.

Similarly, a good quality non-slip flooring that is durable, safe, stain resistant and easy to maintain should be installed in labs to minimise the likelihood of accidents.

To aid in decontamination, work surfaces should be heat, scratch and impact resistant and able to withstand daily use.





## What to consider:

### Chemicals storage

There are strict rules in place governing the storage of hazardous chemicals and it's good practice to include lockable cupboards for these substances and any other potentially dangerous resources. For precise guidance on how to store chemicals, you can refer to regulations such as the Control of Substances Hazardous to Health, the Dangerous Substances and Explosive Atmospheres regulations and the Management of Health and Safety at Work.

### Service outlets

Service outlets such as electric ports and gas taps must be carefully chosen and positioned. For example, gas taps should be securely fixed to prevent students from twisting the pipes and causing them to rupture. They should also have clearly defined 'off' and 'on' positions. Drop lever taps can be ideal as teachers can easily tell if they are off or on, even at a distance. Placing electric and gas ports on the front faces of work units can minimise any tampering during lessons.

### Slips and trips

Slips and trips can be dangerous in any environment, but they're a particular risk in lab areas. To reduce the chances of students falling, it's important to use non-slip flooring. For example, Polyflor vinyl flooring offers impressive slip resistance due to the clear aluminium oxide particles incorporated into the material.

Meanwhile, making sure there is plenty of storage for student's bags and coats can minimise the hazard posed by trips.

## 7. Storage

All too frequently storage in science labs is minimal. On the flipside science lessons are interactive and require a lot of equipment. Combine the awkward shapes and sizes of instruments and teachers are often forced to overload shelves or store materials in close proximity to equipment.

This can result in trips, falls and other clutter-related accidents making storage an ongoing challenge.

Nowadays however, intelligent storage can provide seemingly unthinkable solutions in even the most constrained of spaces, so, it is essential that it is built into the specification.

Locating storage solutions such as lockers in corridors can be a good solution, so long as it does not limit access.

In the room itself, the simple addition of under desk storage and integrated cupboards plus pigeon hole units to store coats and bags all help to minimise clutter.

An innovative in-house development from Innova – the teacher wall – takes this a step further and hides away resources such as interactive screens and power cables, seamlessly. It also incorporates sliding write on whiteboards that can be used to conceal test results or reveal answers to equations.

Minimising clutter and student distractions at the front of the room will help to enhance learning – improve concentration and makes it easier to engage students.





## 8. Technology



Modern learners are used to interactive media and they can access high-quality information and TV programming from any internet connected device.

Mainstream programmes such as BBC's Wonders of the Universe have engaged millions with science. Such inspirational content isn't just for the home – incorporating the latest technology into science labs can make subject material more interesting and digestible.

Technology is an extremely important feature of any high-quality science lab. And the academics agree.

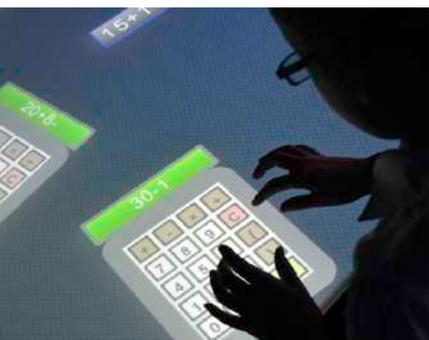
According to Trowbridge, Bybee, & Powell in their 2008

report: "When educational technology tools are used appropriately and effectively in science classrooms, students actively engage in their knowledge construction and improve their thinking and problem solving skills."

Science labs should, therefore, incorporate modern interactive white boards, screens or projectors as well as data collection and analysis software plus digital microscopes that help students absorb scientific knowledge.

A carefully chosen high-power projector or interactive TV can minimise the need to use blinds where rooms feature greater amounts of natural light.





# OUR SUCCESS STORIES

## CASE STUDY : KING EDWARD VI CAMP HILL SCHOOL FOR GIRLS

While staff were in talks about how to unlock funds and upgrade existing science facilities, four former year 11 students at King Edward VI Camp Hill School for Girls in Birmingham entered Innova's national 'Lab of the Future' competition urging pupils to design their ideal science lab. After submitting a very detailed 52-page document, the most detailed proposals the judging panel had ever seen, they were announced the winners!

### Brief

Having been awarded £20,000 towards lab furniture as a prize, King Edward School set itself on a mission to turn the dream lab into a reality. Staff did everything possible to fund the full turnkey conversion, which included ceiling, lighting, M&E works and flooring, to bring to life the 'Lab of the Future' design from Simi Bhamra, Phoebe Thomas, Kate Pham and Chloé Taylor.

### Solutions

Innova was tasked with manufacturing the furniture and installing the lab in just three weeks, repurposing what was a former physics classroom and transforming it into a fully-functional, modern mixed sciences lab to be used primarily for chemistry.

The teacher wall was positioned on the long wall of the science lab which not only shortens the lines of communication but also increases space to install the unique horseshoe desk layout

invented by the girls – designed so that every pupil faces the front of the room and allows the teacher to circulate freely, providing a more collaborative approach to learning.

Sinks were located at the perimeter with deep work benches with the ability to run track experiments. Ample storage options around the perimeter, enables practical lessons to be set up quicker with minimal clutter.

Services such as gas taps and electric outlets, in the form of pluto power modules, were located towards the edge of each bench, away from theory space yet facilitating easy access.

This unique manufacture and installation project inspired by four pupils demonstrates the merits of involving students in classroom design. The new classroom now provides a flexible learning environment that addresses the need for a working classroom and practical laboratory within the same space.



*“ As a school we were very impressed by the girls’ designs so we just had to make the lab a reality. By doing this we are getting a classroom that will work for everybody that uses it – teachers and pupils – like nothing before it. From my point of view I can’t wait to get in there and teach some classes. ”*

*Dr Janet Rose, Assistant Headteacher*

# OUR SUCCESS STORIES

## CASE STUDY : HEADINGTON SCHOOL

Founded in 1915, Headington School is an independent girls' school committed to providing a stimulating and enriching environment for teaching and learning through first-class facilities and resources. Over the last decade, Headington has invested a significant amount in enhancing their facilities and as part of the refurbishment works, the school were looking to modernise the existing labs.

### Brief

Science is a key strength at Headington School and whilst the science faculty building has been constructed fairly recently, the labs no longer met the needs of modern teaching and learning methods.

### Solution

Innova provided a full turnkey solution, including design, manufacture and installation of all furniture as well as M&E works, flooring, ceilings, decoration, heating and extract.

The teaching staff were an integral part of the design process. Innova interpreted their ideas to create unique layouts for both biology and chemistry disciplines, giving teachers the freedom to tailor learning environments to their needs.

The chemistry labs were installed with Innova's

wing layout to give teachers greater control of the learning environment whilst shortening the lines of communication. This versatile solution accommodates both practical and theory work within the same space, with services located on the front face of the benching to allow enough room for theory lessons, but easy access to gas and electric points for practical sessions.

A pebble pod layout has transformed the biology labs into a professional workplace, allowing students to carry out experiments more efficiently and to work together collaboratively. This concept has the flexibility to adapt to a range of teaching needs and curriculum requirements, allowing students to work in smaller groups whilst having access to gas and electric services on the front face of each unit.

High quality, low maintenance materials such as Velstone solid surface guarantee the longevity and good looks across the new laboratories, creating a modern yet timeless feel to a science department designed to inspire future generations of scientists.



# OUR SUCCESS STORIES

## CASE STUDY : SOLIHULL COLLEGE

Solihull College works in partnership with local employers including the NHS to link education with workplace training. With bold new plans to train the next generation of life scientists, the college were looking to align their facilities with their aims by creating two brand new labs that work for all science disciplines.

### Brief

Solihull College trains students for the workplace by working closely with a network of local organisations including Greater Birmingham and Solihull LEP, Heart of England NHS Foundation Trust and the University Hospitals Birmingham NHS Foundation Trust.

### Solution

The resulting two labs feature a configuration that enables students to conduct practical experiments in pairs. Work stations span out from benching that runs around the perimeter of the room, with sinks and gas taps seamlessly incorporated into the units. Electric outlets are located on the front face of each bench, away from the work surface, whilst still easily accessible.

As a pioneering new facility, another objective was to make the facilities look and feel cutting edge. Technology was critical and it has been incorporated

in the form of credit card-sized Raspberry Pi computers that plug in via USB.

To align the facilities with workplace needs, balance tables were an essential specification. Manufactured and installed with precision, the balance tables were attached to the structure of the building to mitigate factors such as small vibrations that effect readings.

Thanks to the two new labs, science facilities at Solihull College are unlike any you would find at a school or college. Not only are they clean uncluttered and built around the college needs, they push the boundaries of science teaching and workplace training.

*“ We are thrilled with the results and look forward to training the next generation of scientists in these brilliant new labs. ”*

*Andrew Schneider, Head of the School for science*



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*Andrew Schneider, Head of the School for Science*

# About Us



“

... a modern, high-tech and stimulating environment ... the future is exciting for UTC Warrington.

”

*Lee Barber, Principal & Chief Executive*

## INTERIORS THAT PUSH THE BOUNDARIES OF LEARNING

Innova Design Group is a British manufacturer and a leading provider of high quality educational interiors, with more than 30 years' experience designing spaces that inspire, attract and motivate staff and students alike.

From furniture installations and single space classroom refurbishments, to extensive new builds and full turnkey solutions, Innova can find pioneering ways to meet the requirements of any educational environment.

By listening to the needs of schools, colleges and universities, Innova designs, manufactures and installs state-of-the-art classrooms to accommodate new styles of teaching and learning. Innova specialises in science laboratories, food technology rooms and ICT suites as well as libraries, design technology rooms, reception areas and vandal resistant washrooms.

For more information about Innova, please visit [www.innovadesigngroup.co.uk](http://www.innovadesigngroup.co.uk) or call 0161 477

