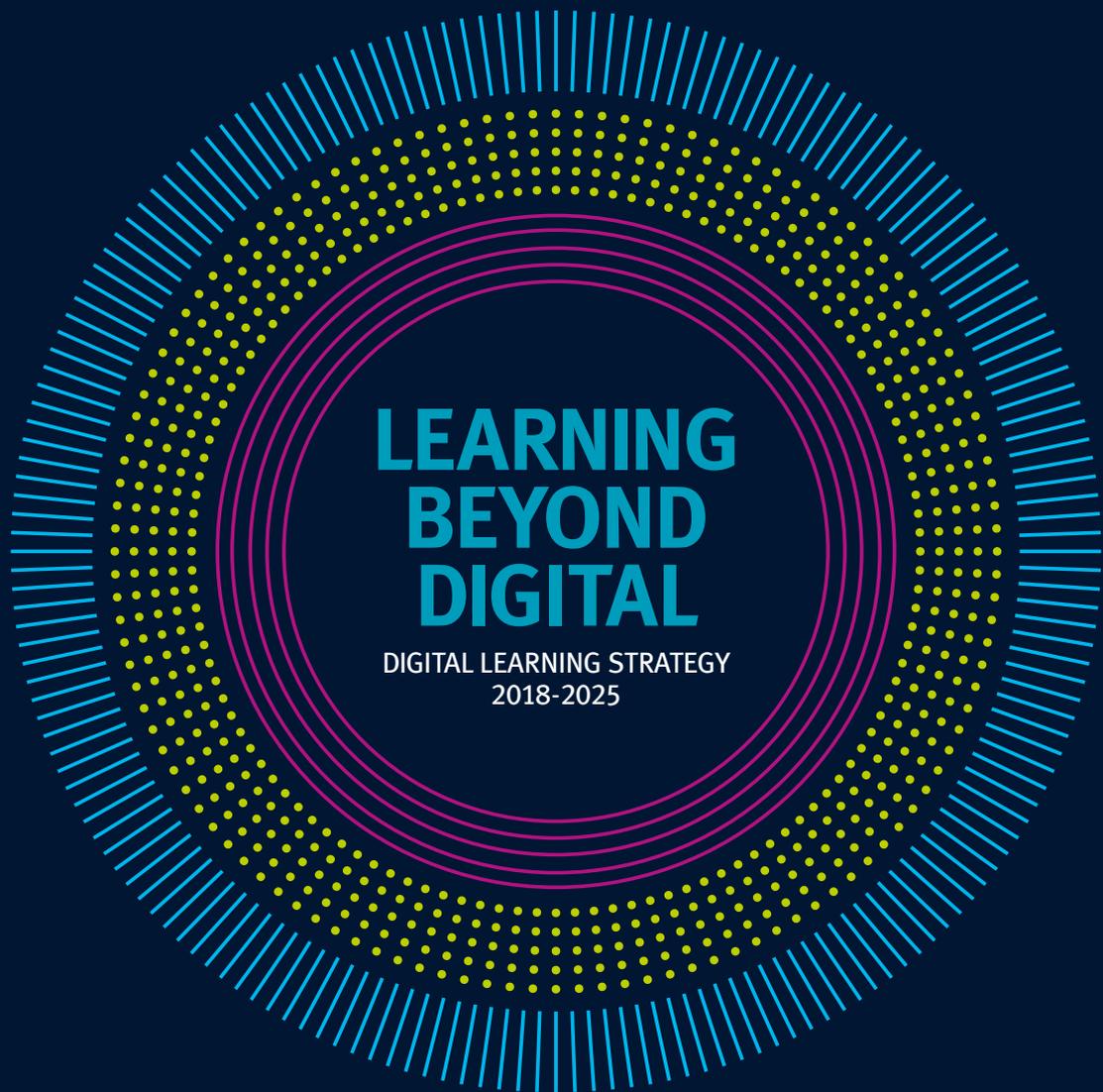
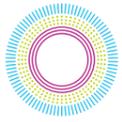


**Imperial College  
London**



**LEARNING  
BEYOND  
DIGITAL**

DIGITAL LEARNING STRATEGY  
2018-2025



# TRANSFORMING EDUCATION



Our ambition is to leverage Imperial's thinking power and technology to transform the way we teach and learn.

GIDEON SHIMSHON  
DIRECTOR DIGITAL LEARNING & INNOVATION



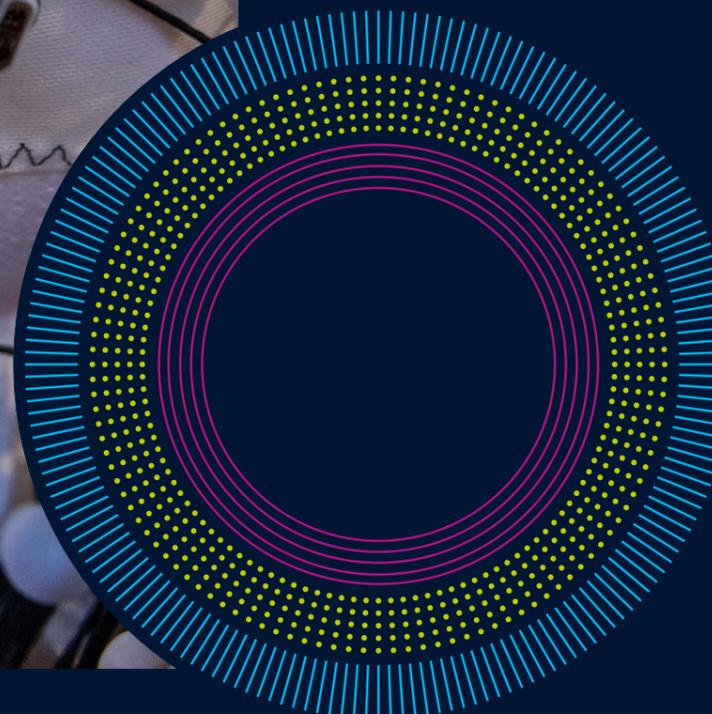
Our vision for the future of the College is to fuse new educational and student-centred developments with innovative technology to transform our learning and teaching. We are moving away from teaching based largely on traditional lecturing to become more interactive, work with our students as partners and create a diverse and inclusive student community on our campuses, aided by digital and online technology. We are also aiming to reach out to millions of prospective learners around the world. Changing our on-campus pedagogy will be the foundation of this transformation and some of the tools to make it happen successfully will be provided by digital technology and will be developed by our educators.

By combining knowledge of how students learn with world-class digital teaching innovations, we can create a future education environment for the College that is built around the student, whilst becoming global leaders in learning and teaching innovation in science, medicine, technology and entrepreneurship.

Imperial's Vice-Provost (Education) Simone Buitendijk emphasises the need to act now: *"I am embracing enhanced digital learning because it offers enormous opportunities to improve the experience of Imperial's students and educators."*

Imperial's Digital Learning Hub and Edtech labs enable staff and students to collaborate in developing new approaches to teaching and learning, to promote successful ideas across the College, and in turn to inspire new generations of educators and students.

The three key areas of focus for us are **experience**, **innovation** and **extension**.



## EXPERIENCE

Digitally enhancing our on-campus experience



## INNOVATION

Develop thought-provoking and impactful learning and teaching technologies



## EXTENSION

Impact society at large through provision of digital learning which is open and accessible globally



# EXPERIENCE

## Transforming the way students learn

Students' expectations of education are changing. At the same time, digital technology is providing new ways of conveying information and sharing knowledge. We are therefore transforming the learning experience for our students and staff. We are creating flexible, multi-functional teaching spaces and introducing interactive learning tools to allow teachers to approach their work in new ways. We are also building learning communities across campus.



Seamless integration of digital content into our teaching pre-, post- and during face-to-face interactive sessions with students opens up extraordinarily rich possibilities for enhancing the quality, effectiveness and fun of the learning experience; we are limited only by our collective ingenuity!

**PROFESSOR ALAN SPIVEY**  
ASSISTANT PROVOST (LEARNING & TEACHING)  
AND PROFESSOR OF SYNTHETIC CHEMISTRY



"We want to use new technology to complement the way medicine has been taught for thousands of years; to improve the way we get ideas and understanding across to our students using all these amazing new opportunities."

**MARTIN LUPTON**  
ASSOCIATE DEAN AND HEAD  
OF UNDERGRADUATE MEDICINE

"This process means we can create visualisations that really fit the course, rather than having to work with what's already available."

**DR CAROLINE CLEWLEY**  
SENIOR TEACHING FELLOW,  
DEPARTMENT OF PHYSICS

"Video is very big in the lives of today's students. We felt we could use it to allow lecturers to do more than stand at the front of the class doing demos."

**SHIREEN LOCK**  
PRINCIPAL LEARNING  
TECHNOLOGIST, FACULTY  
OF ENGINEERING

### Digital inductions

Taking video into the lab



I think the iPad drawings and recordings work very well for this particular task, where drawings are a tool to understand engineering and physics principles.

**DR. KRISTEL FOBELETS**  
READER IN MICROELECTRONICS ENGINEERING

Traditional lab demonstrations are time-consuming, and can be inconsistent in the advice they give. Students who do not have English as a first language can also find them difficult to understand.

Lecture capture by video has been widespread across the College since 2011. In 2016, lab spaces in Chemical Engineering and Earth Sciences were equipped with the technology so lecturers could record experiments from their first year courses. Students could then study the videos before, and even during, their lab sessions.

Positive feedback meant the approach was introduced for second years in October 2017. Lecturers felt the videos complemented their lab teaching. Graduate teaching assistants said they could support students better during lab sessions, and that the students themselves were better prepared.

#### This means:

- Supporting departments to integrate digital elements throughout the curriculum.
- Improving and augmenting our existing digital and physical infrastructure.
- Forging closer connections and collaborations between our students and the rest of the world.
- Investing in research and evaluation to develop new evidence-based pedagogical insights.

### Digital interactive mathematics visualisation

Open-source collaboration

Online visualisations are a powerful way of helping students gain a deeper, more intuitive understanding of difficult concepts in STEM subjects. The challenge is finding suitable visualisations.

Physics Department lecturers and students teamed up during the summer of 2017 for a pilot study to create visualisations for their course. These are now being used in the teaching of undergraduates.

The tools developed and the expertise gained will empower other lecturers to design and build their own bespoke visualisations. Students have been recruited for the next stage of the project this summer, creating visualisations for physics and other courses. The visualisations created will form a library of resources for the future.

### Reimagining the blended classroom

From content to cases

The Medical School is looking at a blended learning strategy as part of its curriculum review. As it decides on the appropriate pedagogical approaches to curriculum content, it is also working with the Digital Learning Hub on how to deliver them.

For example, all medical students are now equipped with iPads. One aim is that whichever campus or hospital students go to, they will be able to access interactive digital learning materials relevant to their clinical learning experience.

The School has already created a new way of presenting the curriculum through Sofia, its electronic curriculum map. It is now investing in new teaching materials to fulfil its blended learning strategy. The result will be major changes in medical students' experience of learning over the next few years.



# INNOVATION

## Pioneering new ways of learning

Higher education institutions are undergoing a massive change as a result of the digital revolution. Imperial's strengths across innovation, technology and entrepreneurship position it perfectly to reinvent itself for the future. We are transforming our pedagogy and creating new educational technologies in collaboration with our teachers and students.



### This means:

- Collaborating with students and staff to develop thought-provoking, impactful learning technologies.
- Facilitating and promoting Edtech projects and spinoffs across the College in collaboration with the Enterprise Lab and the Invention Rooms.
- Experimenting with new value propositions and business models to create new sources of growth.
- Making it easier for departments and teams to collaborate and share ideas and innovations.

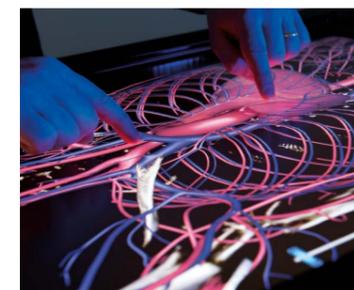
## E-examination system Making the exam suit the course

Using a paper exam booklet for exams involving writing computer code is awkward and unnatural.

Could exams of this sort be taken – and marked – on computers?

The e-examinations project started with the Department of Computing's Networks And Web Security course. The system built for the end-of-course exam makes the exam environment more like real life. It helps with the structure and legibility of answers, and can offer guidance to students on how much to write. It also reduces the volume of answers to mark as some can be checked automatically, with an audit trail for moderators and external examiners.

The Digital Learning Hub is backing the development of the system into a self-service offering to use across Imperial.



## Virtual tutor Turning to AI for support

Student numbers are predicted to double between 2012 and 2025, while the shortage of teachers is expected to grow. Meanwhile universities are expected to maintain and increase the quality of the educational experience for both staff and students.

AI-based student support mechanisms could help. They could relieve pressure on the faculty's time by answering straightforward and frequently-asked questions from students, guiding them toward relevant reading or study resources. They could also encourage peer learning by linking students to each other, connecting them with a lecturer only when necessary.

## Gamifying pure maths Using an app to solve complex problems

Students who play logic-based games like Sudoku on their phones are learning essential skills about how to construct a logical argument. The same principle can be applied to solve more complex problems in a completely new way, in this case giving rigorous mathematical proofs.

The project emerged out of a Thursday evening club in the mathematics department where students work on solving the problems sheets from all the department's courses, but rather than doing so in English they use a computer language called Lean. This broadens the way students think about mathematics and forces them to clarify their ideas, because if their proofs are not rigorous their code will not compile and the computer will not mark the problem as solved.

This autumn Professor Buzzard aims to integrate this approach into his first year Introduction To Proof course as an option, as a first step towards full gamification of pure mathematics.

*"In June I had the crazy idea to become an expert in how computers think about mathematics. Within weeks I was thinking about how to integrate what I'd learnt into my teaching, and suddenly all sorts of Imperial people are appearing in my inbox with questions and comments. I am not so sure that ten years ago this would have happened."*

PROFESSOR KEVIN BUZZARD  
DEPARTMENT OF MATHEMATICS

*"Innovation is transforming education, underpinned by technology which has 'flipped the classroom'. This is providing opportunities for universities to create new ways of adding value to the learning experience focusing on personalised tuition, with more time to experience results from cutting-edge research, rather than learning in traditional lectures."*

PROFESSOR DAVID GANN CBE  
VICE PRESIDENT (INNOVATION)

*"We want to be more experimental, to create something that really meets our needs."*

DR. ROBERT CHATELY  
SENIOR LECTURER,  
COMPUTER SCIENCE

**AI will have a significant impact on teaching and learning, in terms of personalising the learning experience for students, improving the feedback, and making course delivery more efficient for staff.**

PROFESSOR NICK JENNINGS  
VICE-PROVOST RESEARCH AND ENTERPRISE IMPERIAL COLLEGE LONDON



# EXTENSION

## Providing access to the Imperial learning experience beyond our campus

Globally there is a growing demand for high-quality education and not enough universities to provide it. Online educational technologies provide new ways for the College to fulfil its mission to benefit society. By extending our global reach we can share our education and research with new audiences, increasing its impact. Interacting with learners across the globe will also enrich the experience of our staff and students on-campus.



### This means:

- Using educational technology to teach learners who cannot attend our campuses.
- Strengthening our collaborations with partners in all sectors around the world.
- Expanding continuing education opportunities for professionals globally, to enable life-long learning.

## Mathematics for machine learning

Boosting skills at a distance

Machine learning is a booming area, but many of the people looking to get involved do not have the mathematical skills and intuition needed to succeed comfortably.

Taking an online approach means this course will meet a global demand for material which is not currently offered elsewhere, at a scale impossible with traditional teaching. It will help working engineers develop their mathematical intuition, giving them the confidence to succeed in data science and machine learning.

## Digital Academy for Climate

Sharing knowledge on a global scale

**The Digital Academy for Climate provides the opportunity for Imperial academics and colleagues to use their expertise in providing courses which will be of real value to people around the world who need to make decisions on how to transition their activities, whether at national scale or in local communities, for a low-carbon future .**

**PROFESSOR JO HAIGH**  
GRANTHAM INSTITUTE

The most fundamental changes needed to meet the aspirations of the Paris 2013 climate conference are in the sourcing of energy.

The Imperial College London Grantham Institute recently received a significant grant to develop a digital academy as the major component of a new Low-Carbon Power Sector Knowledge Hub. The aim is to share Imperial's understanding of decarbonising economies as widely as possible, in a more cost-effective and less carbon-intensive way than traditional face-to-face methods.

Digital tools mean the course will have a global reach, creating networks of like-minded change agents around the world.

## Global master's in public health

Think local, act global

One of the key challenges in global public health is the lack of trained professionals.

Imperial has offered a Masters in Public Health for 10 years, but the number of students it can reach is limited. Attending also creates problems for public health professionals in low-income countries, who have to find the time and money to come to London to study.

The Online Master's currently in development will make the course content freely available, dramatically increasing its reach and impact. Those students working for the formal qualifications will benefit from real-time support from Imperial's academics, and also from being part of a worldwide community of students and alumni.



**We are not just putting all our lectures on line, we are building a global public health community.**

**PROFESSOR HELEN WARD**  
SCHOOL OF PUBLIC HEALTH



*"This one maths course will reach more people than Imperial does as a whole face-to-face."*

**PROFESSOR DAVID DYE**  
DEPARTMENT OF METALLURGY

*"We are sharing how to deliver decarbonisation, but we are also guiding people through it, and creating a community around it."*

**ALYSSA GILBERT**  
HEAD OF POLICY AND TRANSLATION,  
GRANTHAM INSTITUTE

*"We believe that Edtech can significantly enhance the quality of our education and make our institution accessible to a far larger audience."*

**DAVID LEFEVRE**  
DIRECTOR IMPERIAL BUSINESS SCHOOL EDTECH LAB

# REALISING THE VISION

## The Digital Learning Hub

The Digital Learning Hub will enable us to achieve the ambitions of our digital strategy. It is a source of expertise and the place where departments go for guidance and support as they explore, develop and execute their digital projects. It encourages the adoption of successful projects across the College.

The Hub is already exploring new methods and tools for digital learning. It houses new media studios and design spaces for digital learning across campuses, and will establish an experimental classroom space to explore new modes of teaching and learning.

These complementary approaches – supporting new projects and acting as evangelists for those that have proved their worth – are looked at in more detail opposite.



Learning Experience Design & Delivery



Educational (new) media production



## Approach

### Innovation and Exploration

Organisations around the world have recognised the need to create space for experimentation and new thinking in online learning, and to support innovative thinkers as the pace of technological change accelerates. They have designed their own approaches to R&D and innovation, describing them as labs, centres or schools.

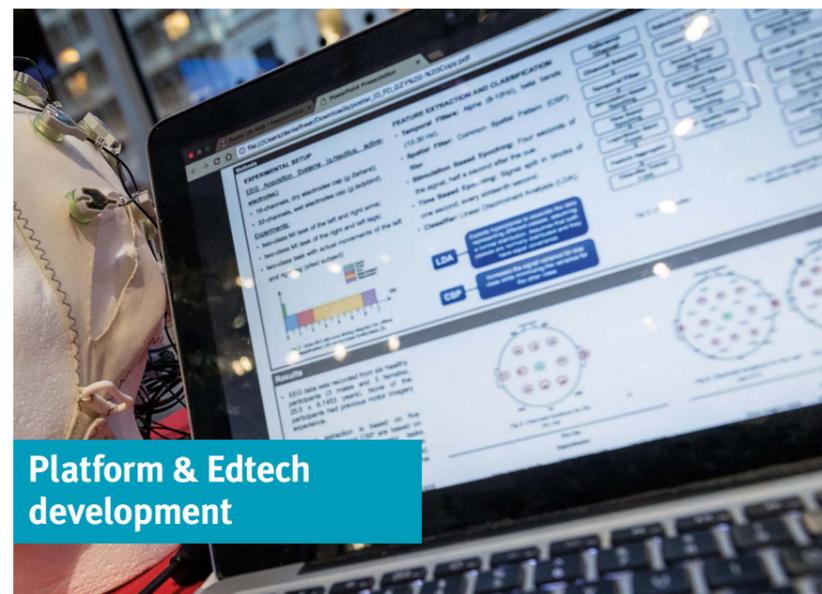
### Scaling and Adoption

The Hub supports innovators and early adopters across the College, providing encouragement and guidance as to how to tackle risk, and helping to bring successful innovations to the early majority. This takes longer than supporting new ideas, and involves greater effort. There are currently a lot of early-stage developments within the College benefiting from the Hub's involvement, and they will continue to do so as they journey towards wider acceptance.



The key benefit being delivered by innovation in learning spaces is the breaking down of academia's traditional silos. This is all about opening up our spaces to enable collaboration between diverse groups. We're also enabling the spaces to be used for active learning by providing equipment and resource, and allowing the users to reconfigure the spaces themselves.

PROFESSOR PETER CHILDS  
HEAD OF THE DYSON SCHOOL OF ENGINEERING



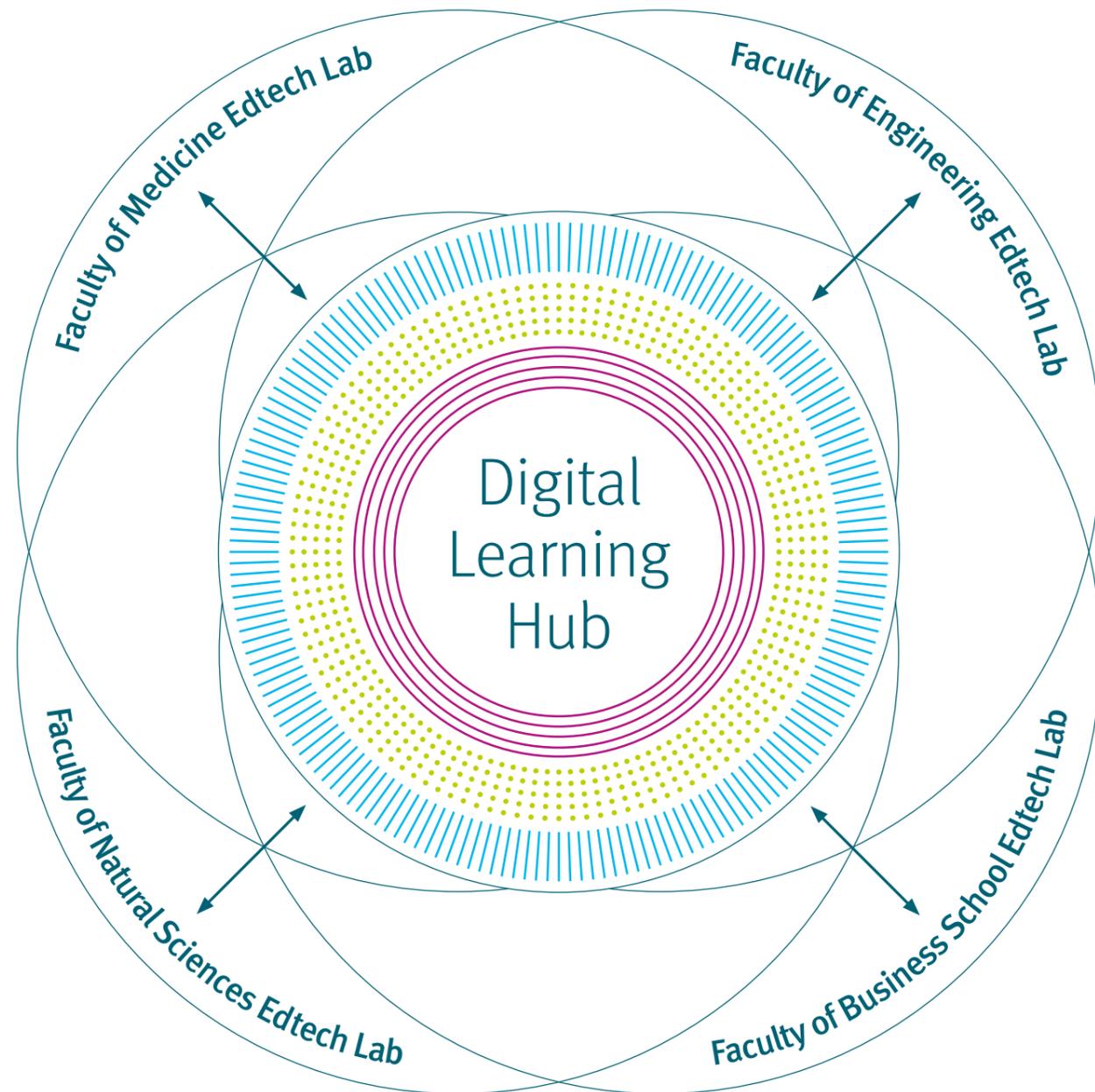
Platform & Edtech development



Product innovation & research support

# REALISING THE VISION

## The Digital Learning Hub



### Enablers

#### Human Capital

Our educators are at the heart of this transformation. We are investing to make sure they have the right skills and capabilities, supporting them to develop digital learning experiences and encouraging them to share their ideas and innovations across the College.

#### Physical Infrastructure

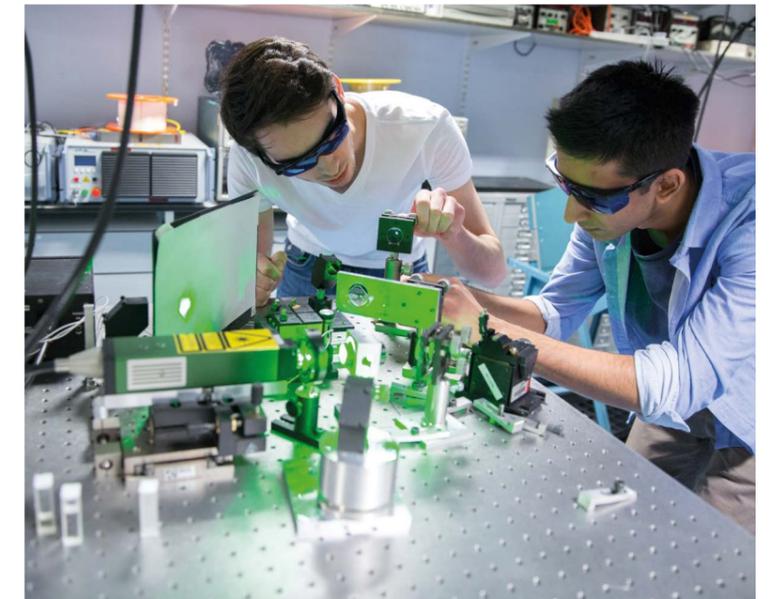
New ways of teaching require new environments. We are creating a vision of how these might develop by building and evaluating new learning and teaching spaces. At the same time we are transforming our existing spaces to support new initiatives and expanding the network of media studios across our campuses.

#### Digital Infrastructure

Achieving our goals will require a determination to improve our existing digital infrastructure, and a willingness to experiment with new platforms and technologies. We are encouraging our innovators to share expertise and best practice throughout the College, whilst making sure all our systems can be adopted by learners and institutions across the globe.

#### Thought Leadership

Imperial is known throughout the world for the quality of its research. We are bringing that knowledge and expertise together from across the College to understand the emerging technological trends affecting education, and we will share the resulting insights with the world.

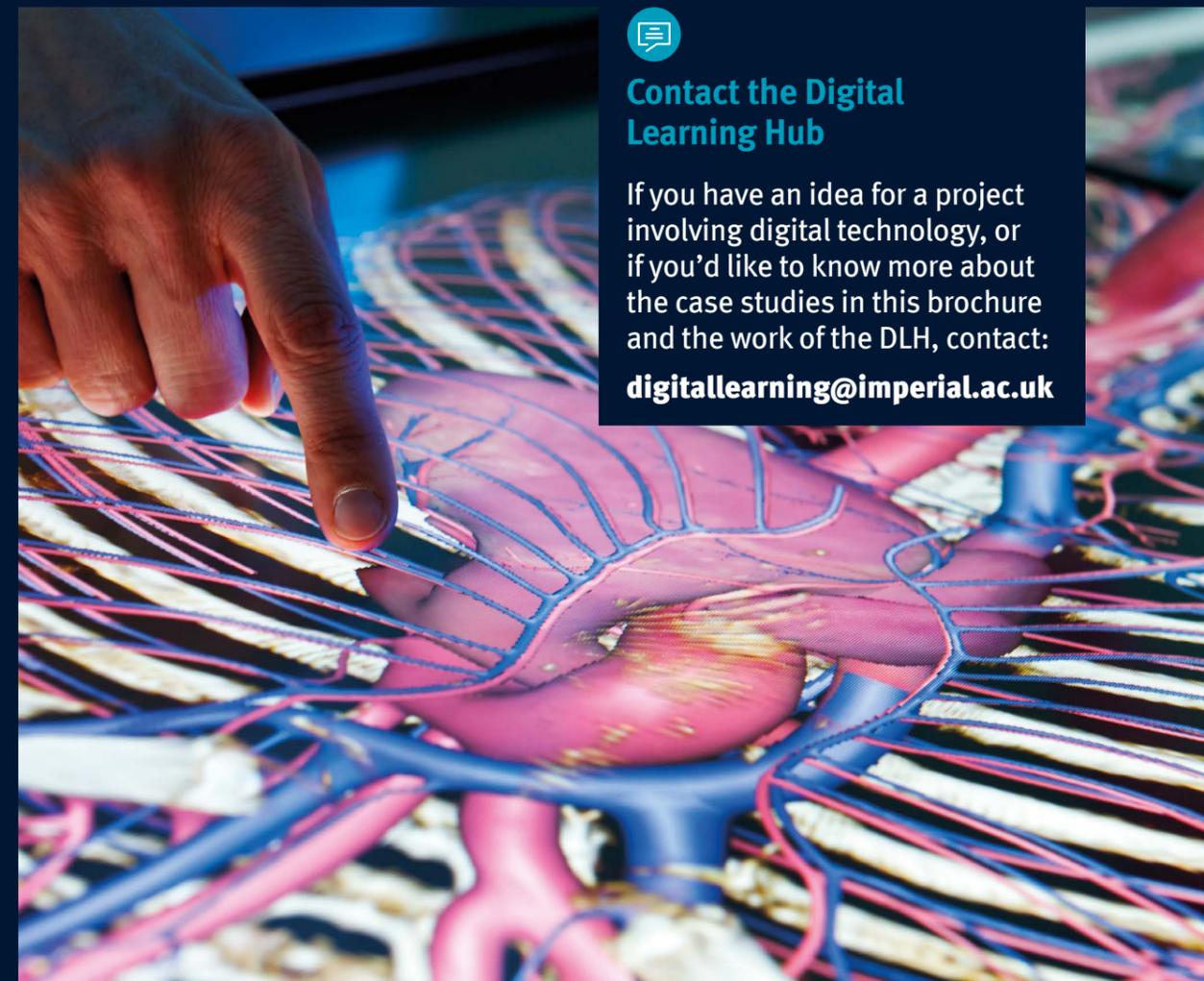


# REALISING THE VISION

## A holistic approach

The Digital Learning Hub will be working across the College to ensure we have the support needed to execute the evaluation and research described in this brochure. We will encourage students to become partners in the process.

Building on Imperial's Educational Development Unit (EDU) expertise in pedagogy and its research capability, research and evaluation projects can be developed around improved learning analytics, the relationship between online and on-campus learning, supporting learning and teaching more generally, and enhancing the student experience.



### Contact the Digital Learning Hub

If you have an idea for a project involving digital technology, or if you'd like to know more about the case studies in this brochure and the work of the DLH, contact:

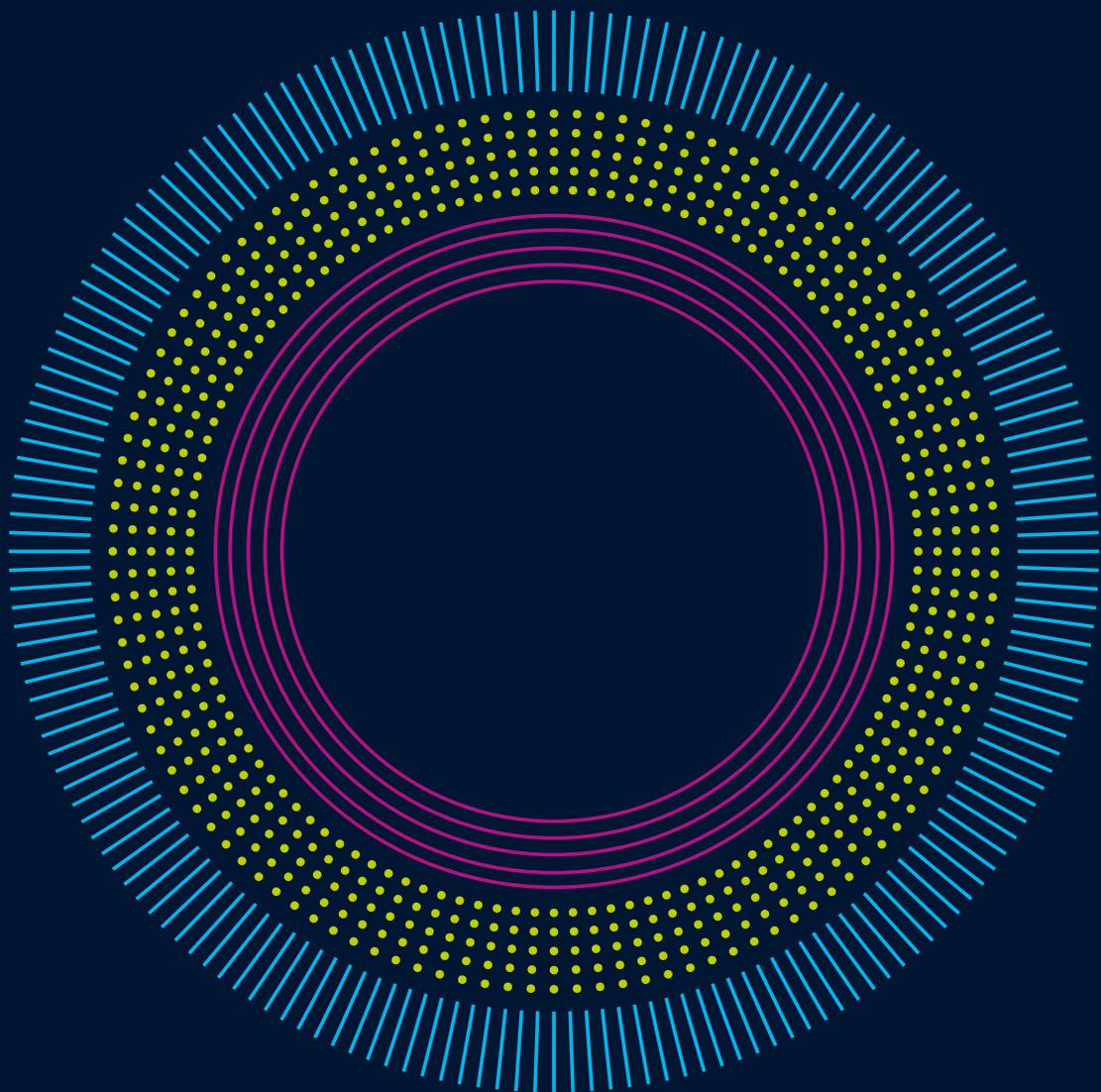
**[digitallearning@imperial.ac.uk](mailto:digitallearning@imperial.ac.uk)**



What is exciting for me is reaching a bigger audience and having a bigger impact, and that it is all rooted in high-quality research.

**PROFESSOR HELEN WARD**  
SCHOOL OF PUBLIC HEALTH





**Imperial College  
London**

For more information visit;  
[www.imperial.ac.uk/learning-and-teaching-strategy/](http://www.imperial.ac.uk/learning-and-teaching-strategy/)