

Imperial College
London

The Wohl Reach Out Lab

Celebrating a decade of
schools outreach excellence



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On the cover: Participants on the STEM Potential programme testing their trebuchets in a physics masterclass

► Participants taking part in a microscopy workshop in the Wohl Reach Out Lab



▲ School pupils and their teacher enjoying a workshop on recycling, materials and sustainability

Foreword

“When the Wohl Reach Out Lab opened in 2010, it was the first of its kind – a state-of-the-art laboratory for school children of both primary and secondary age to engage in practical science. As the UK’s most innovative university with a dedication to educational outreach, Imperial College London provided the ideal location to realise a new landscape for science, technology, engineering and maths (STEM) engagement. Ten years on, we are proud to see the fruits of this vision with many former participants of the Wohl Reach Out Lab programmes progressing to STEM degrees at higher education institutions including Imperial itself.

We know that a lack of adequate experimental work in schools is a serious deficiency in science education, which can result in a lack of interest in STEM subjects. We developed the Wohl Reach Out Lab so that young people can engage in hands-on science experiments that work to spark their interest in STEM subjects.

With STEM graduates earning a starting salary almost 20% higher than those graduating in other subjects, a science degree can be an important pathway to social mobility for young people from lower-income households.

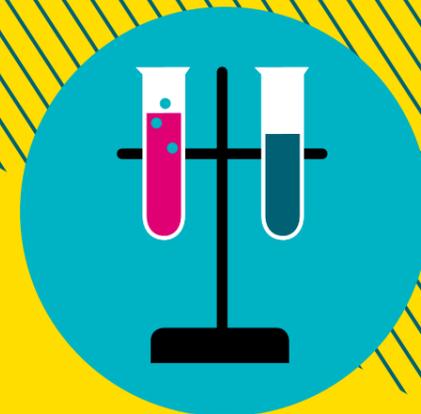
By exciting children about science and by promoting awareness of STEM careers, the Wohl Reach Out Lab encourages and supports young people to broaden their horizons and realise their aspirations. By providing access

to world-class lab facilities and activities led by subject experts, we enrich the curriculum and connect children with science in the classroom. And, through sustained engagement with the Wohl Reach Out Lab, children gain a better understanding of science, commit more to their studies and set higher career goals.

In the Wohl Reach Out Lab, we have seen this at first hand. We do not merely wish to create new young scientists but also to improve science literacy so our society uses science with wisdom. Children leave our laboratory learning that science is relevant, bringing value to society. They see at first hand that scientists have important ethical values but are ordinary people like themselves. Thus, many gain aspirations as they learn that a career in science is achievable. Personally, I feel that this work is as important as anything I have done in science and medicine during my career. All of us extend our thanks to those who have shown their generous support over the past ten years.”

Professor Lord Robert Winston





39,200

pupils from schools across London and more widely, have visited the lab

400

participants have gone on to secure a place to study at Imperial.

We've supported over

54,000

teachers

▲ Bringing like-minded young people together is an important part of our cohort programmes

Introduction

“The Wohl Reach Out Lab (WROL) opened its doors in 2010 with an aim to provide a dedicated STEM space where Imperial’s team of subject experts could deliver educational activities to raise expectations and scientific understanding in young people. Since then, over 39,000 pupils from schools across London and more widely, have visited the lab and taken part in hands-on science experiments that a lack of equipment in their own school or college can put beyond their reach.

The lab welcomes young people of all abilities and backgrounds with an emphasis on inspiring and showing them something new and exciting that brings science to life. It has been our mission to increase the enjoyment of science and expectations of the young people we work with through the lab and with great success – to date **400 participants have gone on to secure a place to study at Imperial.** But it’s not only about securing a place at Imperial – many

participants have gone on to study at other fine universities, and even more importantly, the excitement pupils experience is palpable when you walk into a session in the WROL.

The WROL also operates online in the form of a professional development tool which gives every primary school teacher free access to a range of support and materials to help them teach science with confidence. To date **we’ve supported over 54,000 teachers this way**, helping them to make science fun in the classroom. And during the COVID era we’ve flipped many activities online – ensuring that pupils still get that practical experience by providing basic equipment and reagents that they can use at home.

It’s not only school children and teachers who we are aiming to educate; a key principle of the WROL is to provide a research base that we can use to find out the best ways to inspire school students.

It has been a privilege to support the mission of the WROL and I am so proud of what our amazing Outreach team has achieved. But none of this would have been possible without the generosity of all those who have supported the lab in some way and helped to bring science to life for so many children across the UK – thank you.”

Professor Maggie Dallman



▲ A glowing outcome! A summer school participant successfully synthesised Luminol

Our mission

→ Imperial College London is a university with a global reputation for excellence in teaching and research in engineering, medicine, science, business, and the application of these skills to industry and enterprise. Consistently ranked within the top three universities in the UK and Europe, and the top ten worldwide, Imperial attracts the very best students and academics from across the globe.

As a university focused on science and its impact in the world, we want to share our passions with other inquiring minds. Our staff and students work with schools, colleges, parents and community organisations, sharing their expertise to engage young people in science, technology, engineering and maths (STEM). We aim to help young people to realise their aspirations, ensuring that they understand what opportunities are available to them after leaving school, and helping them to fulfil their potential.



We're seeking to engage more young people with the world of science and technology, regardless of their background. There is strong evidence that school pupils from state schools experience barriers to studying science at university. Data from the Department of Education shows that at A-Level, only 15% of science grades awarded to disadvantaged pupils were an A or A*, compared to 26% for non-disadvantaged pupils. A gap at GCSE is also seen between state school pupils and independent school pupils. 48% of state school pupils were awarded a good pass in their science GCSEs, compared to 81% for independent school pupils. Furthermore, state school pupils are also less likely to be taught by teachers with a degree in the subject – 80% of physics teachers at independent schools have a physics degree, compared to only 30% in state schools.

Through our schools outreach activities we are committed to breaking down these barriers and providing a wide range of inspiring activities for young people from disadvantaged backgrounds to close attainment gaps, change perceptions, support teaching staff and stimulate interest in STEM subjects from primary through to A-Level education. Through these activities it is our mission to build the confidence and nurture the potential of the next generation of scientists.

▼ School pupils from Westminster Academy demonstrating their 'tricks' following their science communication masterclass



The Wohl Reach Out Lab at 10

→ Over the last ten years, we are proud to have delivered over 1,500 different STEM activities and workshops through the Wohl Reach Out Lab to participants from over 1,900 different schools, 899 of which are in London.

The activities that take place in the WROL are a combination of enrichment sessions for younger school children and science-based curriculum programmes for secondary age pupils. Sessions for primary age pupils include workshops which are designed to ignite their interest in STEM subjects. Science-based curriculum programmes for secondary age pupils aim to increase their confidence and help schools with raising attainment – this includes our summer schools and university access support programmes. All activities have been and continue to be focused on hands-on STEM practicals and learning.



Over
39,200
participants

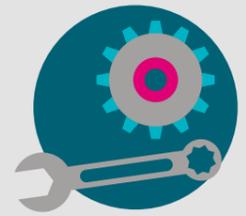


54,652
teachers enrolled on Reach Out CPD with over 88,000 courses and 370,000+ units of work completed.

1,909
schools
899
of which in London



Over
8,000
staff and students have supported or engaged in activities



Over
1,500
different activities or workshops



Over
800
participants in WROL activities have applied to study at Imperial, with 400 successfully embarking on a degree course

600
young people were supported during summer 2020



2
PhD projects

SPOTLIGHT

STEM Potential

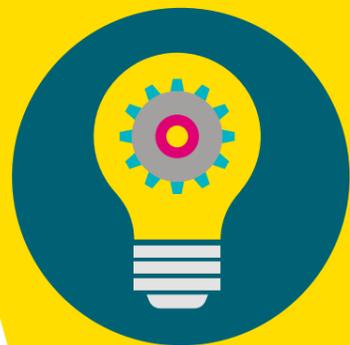
Over 1,000 participants have taken part in STEM Potential, a programme aimed at high-achieving young people from backgrounds underrepresented in higher education. There are two entry points, at Year 10 and Year 12. STEM Potential was developed to help these young people discover the wide range of subjects within STEM studies and aid their progression to university.

Participants joining us in Year 10 spend two years exploring different STEM fields to gain a better understanding of subjects they may wish to study at A-level. They also attend on-campus taster events for an insight into university life. Depending on GCSE performance, A-level choices, aptitude, and overall commitment to the programme, many participants will progress from the Year 10 to the Year 12 programme.

Year 12 participants embark on a more advanced programme, covering subject-specific workshops relevant to the STEM subjects they are undertaking at A-level. Participants are also paired with a current Imperial undergraduate e-mentor for peer support and information, alongside professional support from the College with their university applications, personal statements and interviews.

“STEM Potential has been one of the greatest experiences I have ever had. It has given me the much-needed support in A-levels, and university applications, and without them, I believe I would be nowhere. Coming in on a weekend to be supported by an array of academics and mentors, to support my journey, is invaluable. The mentors are willing to give you help every step of the way – having them there to advise, guide and be by your side is amazing.”

Nabeeha, STEM Potential participant



▼ Our undergraduate ambassadors are an invaluable source of information and advice



SPOTLIGHT

Westminster Academy

▲ School pupils from Westminster Academy taking part in a workshop in the Wohl Reach Out Lab

The WROL is also home to our collaborative Westminster Academy Programme. Established in 2014, the Westminster Academy Programme delivers STEM curriculum enhancement within the WROL to secondary school age pupils. Through the programme we also engage with Westminster Academy’s local community, such as through hosting Primary Science events for their local feeder primary schools. The partnership has existed for over six academic years and continues to make a significant contribution to the WROL’s overarching aim of raising the STEM-based academic aspirations of school children.

The Programme has provided many opportunities for Imperial’s post-graduate and post-doctoral research community to showcase their subject specialisms to the school pupils. Furthermore, the Programme has also provided opportunities for Imperial’s student population to undertake invaluable mentoring and tutoring work. By engaging with schoolchildren visiting the WROL, Imperial students are learning how to make their knowledge accessible and stimulating to a younger audience.

On each of the scheduled days of the Programme, pupils and accompanying teachers from Westminster Academy spend a full day at the WROL, taking part in hands-on learning facilitated by academics from various departments across the College. Each session is supported by undergraduate student ambassadors who are students of the relevant STEM discipline. Through their interactions with the ambassadors, pupils also gain an insight into academic life and the experience of studying science at a university.

We asked participants about their favourite part of the Programme:

“I loved how hands on it was.”
Participant aged 15, Year 10, Physics

“I liked the balance of activity and the presentation of learning, starting with simple activity and finishing with dissection, was fun.”
Participant aged 17, Year 13, Biology

“I like how we had opportunities to do things that we don’t have in school”
Participant, Year 7

“Gives a chance to be completely independent, yet you get assistance if required.”
Participant aged 14, Year 10, Physics



▲ Pupils demonstrating their ‘tricks’ following their science communication masterclass



SPOTLIGHT

Primary workshops and activities

We have also brought science to life for younger children through individual workshops and activities designed to inspire them and ignite their interest in STEM subjects at a young age.

We recognise that through working with school pupils as early as possible we can demystify science and encourage young school children to study STEM subjects in the future. For example, through our States of Matter workshop pupils investigate the melting point of different types of chocolate (white, milk and dark), watch demonstrations using liquid nitrogen and take part in experiments which use dry ice – before finishing off the day with the exciting taste of liquid nitrogen ice cream!

▼ Primary school pupils getting their hands dirty investigating the properties of slime!

“The children were so engaged and excited. They loved learning about new and wonderful things in the world. They become more and more intrigued in science.”

Primary Teacher

“A fantastic opportunity for pupils to ‘feel’ like a scientist and carry out experiments that are not possible in school!”

Primary Teacher



▶ Holly, speaking with fellow outreach programme alumni and ambassadors, Jack and Harshil

CASE STUDY

Holly

→ My name is Holly. I am a first-generation student from a region in England where few people go to university. In 2020, I graduated from Imperial College London with a first-class honours degree in biochemistry.

When I was in Year 11, a teacher informed me that I may be eligible for free summer schools at different universities. I began researching and came across the Imperial College London Project STEM summer school. I thought it was very unlikely that I would be accepted onto the programme, but I decided to apply anyway. After attending this summer school, I decided to apply for the STEM Potential programme. As a participant on the STEM Potential programme, I was able to travel to London every couple of months for workshops in the WROL. This required a lot of commitment, but this was a great opportunity for me to meet university students and ask them about their experiences. As a part of this programme, I also had a dedicated e-mentor I could contact regarding biochemistry and university in general.

I was delighted when my application for biochemistry at Imperial was accepted. As soon as I started, I knew that I wanted to be involved in WROL activities at the university. These programmes were so beneficial for me during my time at school that I wanted to give back to young people from similar backgrounds to myself. I was able to learn an immense amount from

being involved with the Wohl Reach Out Lab as both a student and as an ambassador. Being an Outreach STEM Ambassador was a very rewarding experience with a huge variety of responsibilities. I have been fortunate enough to work with young people during both in-person and online summer schools and other workshops and I can see first-hand how they benefit from the opportunity to engage with current university students and learn interesting science content.

I now work as an Admissions Representative in the Access and Widening Participation team at the University of St Andrews. Through my own experience, and by working as an Outreach STEM Ambassador, I understand the importance of widening participation to those from underrepresented backgrounds in higher education. Having directly benefited from outreach events and residential summer schools, I know the benefits that these programmes have. These experiences have resulted in me wanting to play an active role in widening participation and engaging with young people who benefit from outreach events.



Building sustained relationships and collaboration

▲ Our research community is a vital part in bringing STEM to life. This session explored fluid mechanics, led by one of our Physics researchers



A hub and spoke model – working with individual schools to widen our reach to other local schools – has been used to create **sustained relationships** with schools in other areas of London and the South East based on the WROL model of hands on engagement. This model has led to programmes supported by the London Schools Excellence Fund (Greater London Authority) and UKRI, looking at using researchers to support STEM teachers at both primary and secondary level.

The importance placed on primary science as part of these programmes enabled evidence to be gathered that supported the university in jointly creating Reach Out CPD, an online professional development resource focused on science topics for primary school teachers in partnership with Twig Education. To date there have been **54,652 teachers enrolled on Reach Out CPD**, with over 88,000 courses and over 370,000 units of work completed. Our research has found that engagement with practicing scientists allows science teachers to re-engage the ‘scientist’ dimension of their professional identity - with obvious benefits for classroom practice.

Extending our partnership with Twig Education, in November 2016 we launched an online primary science news service, **Reach Out Reporter**, which helps teachers integrate topical science into everyday teaching and learning. Reach Out Reporter engages primary school children with the wonders of the world around them using high-quality films and other learning resources. The service is updated weekly with new content and is available free of charge to all primary school teachers, pupils and their parents across the UK. Since its launch there have been more than 48,000 unique visitors to the site. Reach Out Reporter has won an Education Resources Award for best Free Educational Resource and an Educational Multimedia Award at the Learning on Screen Awards.



More than
48,000
unique visitors to the
Reach Out Reporter site.

SPOTLIGHT

Reach Out CPD

Reach Out CPD is a free online science Continuing Professional Development (CPD) resource for UK primary school teachers, launched in 2014. It has been developed by Imperial College London in partnership with Twig Education.

This web-based programme provides teachers with resources and ideas to support their teaching and engage primary school children in science.

Reach Out CPD courses support teachers with core subject knowledge, fun practical activities and films featuring Imperial academics and contributors from other leading public science organisations. These experts illuminate some of the latest exciting advances in science and present imaginative ideas to bring science to life in the classroom.



“It’s great – I would recommend it to all colleagues. Science can be challenging – especially when children’s minds turn to any kind of questions. Reach Out CPD helps you answer those questions and help children investigate their own questions and ideas. It gives teachers confidence to teach and children confidence to think like scientists.”

Primary School Teacher

The WROL set out to forge **collaborations** with other institutions within the UK and around the world and aims to share and learn from best practice across the sector. To name a few, select collaborations; it has hosted delegations with the British Council, shared learning with numerous universities, run collaborative programmes with universities such as Kings College London, the Royal Veterinary College and University of Southampton, hosted programmes for young people from as far away as South Korea, Hong Kong and China and is developing a collaborative project for young people with Israeli universities.

▼ Philanthropic funding enabled us to develop programmes that gave teachers the opportunity to explore different areas of STEM in more depth.



A culture change

The WROL initiative was at the forefront of a culture change within the College and has created generations of undergraduate and postgraduate students who are socially responsible and actively want to give their time and energy to young people.

Most activities and programmes run by the central Outreach team at Imperial are led from the front by current researchers providing the participants with a relatable link to their school curriculum. Undergraduate students support every activity, whether it is providing problem solving support during a practical session or providing their STEM experiences over a networking lunch. The input from the student community at Imperial is one of the things that make this space and the outreach work that takes place within it relevant and inspiring. **Over 8,000 staff and students have supported or engaged with activities** in the WROL since its opening and growing numbers of these move into teaching after graduation or into professional roles with significant engagement with young people. In recent years, more and more young people who experienced our activities in their school lives are enrolling at Imperial. So far 800 participants in WROL activities have applied to study at Imperial, with 400 successfully embarking on a degree course with us. Many of these are signing up to be part of the ambassador team creating a network of connected and likeminded students.

▼ Our summer schools allow young people to explore subjects in depth. Our participants are exploring our home-made sandbox in a physics session



But it isn't just the student body that has changed. The WROL initiative created space and opportunity for staff and students to engage outside of the College with the public and contributed to a huge increase in the scale and the importance placed upon societal engagement across the College. In 2017, using learnings from the WROL we established the Invention Rooms in White City, a unique space where Imperial and the community can come together to collaborate and get hands on experience of making and prototyping.

The Invention Rooms are made up of three unique spaces:

- ▶ **The Dangoor Reach Out Makerspace**, a workshop and design studio which offers free after-school programmes for local young people and has further expanded our schools outreach offering.
- ▶ **The Advanced Hackspace**, a workshop facility for staff students and partners to develop new ideas and prototypes.
- ▶ **The Invention Rooms Café**, a space for events and activities with the local community including science workshops and tech drop-in sessions.

Furthermore, societal engagement has now become part of the College strategy. Engagement networks have been created and sustained connecting staff and students across faculties and support services, and the breadth of events and programmes of engagement has exponentially increased in the last ten years.



Academic research

▲ The Reach Out Lab contains equipment inaccessible to most schools. These school pupils are exploring spectroscopy, learning the theory alongside the practical, by preparing and analysing their own chemical samples

Conducting academic research and using the WROL as a case-study in science education was one of the founding principles ingrained from the WROL's inception. Two PhD projects have been conducted in the WROL. Dr. Alex Moss completed his research in 2015, looking at and evaluating the impact of the STEM outreach programmes held within the Lab upon London school pupils. Following on from this, Roberts Zivtins began his own project in 2017 and is due to complete in 2021.

Roberts is using the partnership between the WROL and a local secondary school as a case-study to investigate the pedagogy of science outreach. His PhD project focusses on exploring widening participation initiatives, using 'science capital' theory (Archer et al., 2015) to help explain patterns of inclusion and exclusion of pupils from minoritized groups in the science sector.

Findings from observation, in particular, highlight how the WROL helps visiting school pupils engage with key elements of practical science, which previous research has shown that minoritised pupils have less access to. Observation has shown how important impromptu conversations with undergraduate mentors can be in helping to prepare

visiting pupils for navigating the university admissions process. School pupils and Imperial undergraduate ambassadors were frequently observed talking about tuition fees and student finance, university interview technique, how to choose a university and how to choose a course – all topics which previous work has shown that minoritised school pupils are less likely to discuss at home or school, when compared to peers.

Visiting pupils, kind enough to give up part of their lunchtime to take part in focus groups, have spoken about their experiences of science outside of the WROL and state how acutely aware they are of their exclusion from the science sector. These findings further strengthen the view that out-of-school learning experiences, which include pupils in the everyday practices of science and move science beyond the school curriculum, are important for widening participation. Most recently, the research has been presented at several conferences including the European Association for Research on Learning and Instruction (EARLI) conference in 2019 and a paper has recently been published in the journal of Widening Participation & Lifelong Learning and within Research Intelligence magazine.

What's next for the Wohl Reach Out Lab?

Recently due to the disruption caused by Covid-19, activities have moved into the digital space. Whilst this minimised the hands-on nature of our work, it has enabled us to continue to provide meaningful STEM content to young people to support their education at an incredibly difficult time. Using a mixture of different types of content and posting basic equipment and materials to school pupils, we were able to provide in-depth support for over 600 young people aged 14-18 from around the UK during summer 2020.



SPOTLIGHT

REMOTE LEARNING

In July 2020 items such as **Arduino kits**, an open-source electronics prototyping kit, and smart materials were posted to Year 12 participants taking part in the Electrical and Electronic Engineering and Materials Science and Engineering streams of our work experience programme. The Arduino kits formed the basis of a project completed over the course of the programme culminating in the participants showcasing what they had made to their peers. The smart materials box formed part of an interactive session in the Materials Science and Engineering stream where participants conducted experiments in their homes and shared their data as a group.

We also sent items to participants on the Chemistry stream of our Year 12 **Sutton Trust Summer School**. These items allowed the participants to take part in a live Chemistry cook along, led by the team behind Imperial's Chemical Kitchen. This session involved them making cheese and participants were encouraged to share photographs of their end products.

We have also been sending kits to our **STEM Potential** participants to use as part of our interactive online workshops. These have included materials for at home titrations, making pH indicators and conducting experiments on circular motion. Future kits to be sent out include everything needed to build a mini Theremin and modelling materials to create organic chemistry molecules and compounds.

All kits that are sent to participants are theirs to keep and we are committed to increasing the amount of hands on activities that can complement our virtual sessions.

▼ Providing a wide range of hands-on experiences for pupils in primary and early secondary school is core to our future plans.



Moving forwards, we plan to focus on continuing to develop more opportunities for schools to take part in hands-on science activities in the WROL, and focus on using the WROL to address the learning gaps for young people who have been affected by the pandemic.

In the shorter term, we are focusing on providing opportunities for interactive online demonstrations of science, and utilising this to determine how best to use technology for optimising engagement virtually. The WROL team are continually creating and delivering diverse activities to different participants – from research focused webinars to widen perspectives of school students in Key Stage 5 to virtually delivered hands-on STEM after-school clubs to primary schools. The team will continue to plan future activities combining both face to face and digital mechanisms of engagement enabling reach further outside of London.

▼ Our ambassadors support participants in all their sessions with us, providing unique opportunities for facilitated small group work



Beyond the pandemic, we plan to develop and launch programmes that create a sense of belonging with the WROL. Here, we are keen to work with young people in primary schools and in Key Stage 3 to further improve literacy and excitement in STEM under a framework of 'STEM in Action'.

SUPPORT US

If you would like to discuss how you can support our future plans, please contact:

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Thank you

We are thankful for all the support that we have received over the past 10 years. The founding of the Wohl Reach Out Lab and its programmes has made a significant impact on the participants who have taken part in our programmes, our College community and culture as a whole.

In particular we would like to extend our thanks to our donors and supporters through whom the Wohl Reach Out Lab was made possible:

Maurice Wohl Charitable Foundation

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Marit Mohn
The Mayor of London
Office Depot
The PF Charitable Trust
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The Sir John Ritblat Family Foundation
UKRI
And one Anonymous donor



► STEM Potential participants taking part in a curriculum focused biology session

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www.imperial.ac.uk/outreach

