

Royal Botanic Gardens

Kew

Schools Learning Strategy 2019–2024

Bringing plant science to life
for schools everywhere



Foreword

Children starting school today can expect to live into the 22nd century. Between now and then they will likely experience significant changes in climate and biodiversity that will affect their lives. Apprehension about how forecast environmental shifts will manifest is already contributing to increased levels of eco-anxiety (a chronic fear of environmental doom), and children are participating in school strikes worldwide to voice their concerns and demand greater action.

Addressing the environmental challenges to come requires schools to prepare children for managing natural assets sustainably once they reach adulthood. Plants and fungi are fundamental to all life on Earth, so first and foremost we must equip children with the knowledge to grasp this essential truth. Our mission at the Royal Botanic Gardens, Kew (RBG Kew) is to understand and protect plants and fungi for the wellbeing of people and the future of all life on Earth, and our schools learning programme has a key role to play in this.

We must also provide learning opportunities that support children to develop scientific skills and adopt pro-environment values and attitudes. At present, throughout their school careers in England, pupils are taught about plants and fungi mainly in biology and geography. However, from September 2025, young people will be able to study for a new General Certificate of Secondary Education (GCSE) in natural history. Effective teacher-training is critical for ensuring pupils experience high-quality science education whatever subject pathway they choose.

Kew has an extraordinary wealth of natural and intellectual resources – encompassing living and preserved specimens; historical and contemporary books, journals, objects and illustrations; and horticultural and botanical experts. We harness these resources in our schools' learning programme, using popular foods, drinks and materials as entry points for teaching complex concepts such as the carbon cycle, ecosystem services and pollination. This helps to demonstrate and build understanding of just how important and relevant plants and fungi are to pupils' lives. Through teaching, training teachers and developing innovative resources for schools, we aim to inspire the next generation of expert plant and fungal scientists.

RBG Kew already runs one of the largest botanic garden schools' programmes globally but we have the potential to do much more. This strategy outlines five priorities that will enable us to bring about transformative change, by expanding our reach to engage with all schools across the UK and to connect with many schools internationally. Our aim is for our schools learning programme to be recognised both at home and abroad as the gold standard for schools learning in plant and fungal science. There is no time to lose if we are to nurture a generation capable of halting biodiversity loss and avoiding the worst impacts of climate change within their lifetimes.







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A long history of learning at RBG Kew

For four decades, RBG Kew's¹ schools learning programme has been inspiring the next generation to engage with the natural world. Building on an educational foundation that began in 1859 when Kew Gardens started training students to become garden curators, we now target early years, primary and secondary schoolchildren aged between three and 18. Every year, barring the exceptional years of the pandemic, more than 90,000 pupils visit Kew Gardens, and 11,000 attend educational days out at Wakehurst. They explore wide-ranging themes, such as how plants survive in extreme conditions, the links between art and science, and the importance of plants at the base of food chains.

Education is fundamental to Kew, not least because it is among our statutory responsibilities. As an arms-length body of Defra and a charity, we have a 'public purpose' under the 1983 Heritage Act to 'provide advice, instruction and education in relation to those aspects of the science of plants with which the Board are for the time being in fact concerned'. RBG Kew's current mission is 'to understand and protect plants and fungi for the wellbeing of people and the future of all life on Earth'.

RBG Kew's resources encompass the plants and fungi growing at Kew Gardens and Wakehurst and stored as seeds in the Millennium Seed Bank; preserved specimens in the Herbarium and Fungarium; DNA samples and wood slides; the institution's historic buildings; and its library and archives, which are packed with plant- and fungi-related books, artworks and objects related to economic botany. These provide a rich educational treasure trove (Box 1). Many topics covered by the National Curriculum – from evolution and genetics, to climate change and conservation – can be examined, questioned and interpreted through a botanical lens at Kew Gardens and Wakehurst.

RBG Kew's educational record is strong on both national and international stages. In 2016, it was involved with the London Curriculum, designed to help pupils make a positive connection with the UK's capital city. This mayoral initiative provides resources and events for teachers and pupils at museums, gardens, theatres, music venues and other institutions, including Kew Gardens. And between 2010 and 2013, RBG Kew took part in the INQUIRE project (part of the Science in Society Programme of the European Commission), involving 17 partners in 11 countries. The programme focused on the use of Inquiry-Based Science Education (Box 6 on page 24) to understand biodiversity loss and climate change.

BOX 1:

Reviving the practice of school museums

Two London primary schools launched temporary museums of botany in 2019, as part of a collaboration with RBG Kew and Royal Holloway, University of London¹. Wilberforce School in Westminster and St. Monica's Primary School in Hackney exhibited plant-based artefacts – including a woven bag, a pan flute and an Ethiopian cross – from RBG Kew's ethnobotanical collection and pupils' homes. Designed to illustrate different histories and cultures, the work was part of the three-year 'Mobile Museum' programme, which explored the movement of objects in and out of Kew's Economic Botany Collection since its creation in 1847¹.

During the late 19th and early 20th centuries, object-based learning using school museums was a popular form of teaching. RBG Kew's records show that during this period, Kew Gardens dispatched plant-based objects to 400 museums worldwide and 700 schools across the UK. The Mobile Museum programme, with funding from the Arts and Humanities Research Council, enabled RBG Kew and Royal Holloway to investigate why the objects were sent – which uncovered a rich and largely forgotten practice of using natural specimens in Victorian schools.

The schools' element of the programme proved to be a profound and meaningful experience for the teachers, pupils and families involved. Evaluation demonstrated an increase in awareness of cultural diversity in the school community and improved understanding of the need to use plants sustainably. It also revealed improved home-school relations, highlighting the importance of valuing parental expertise in children's learning. Revisioning mobile museums in schools today could help pupils to learn about contemporary issues of climate change and biodiversity loss, as well as shape new narratives from the past.

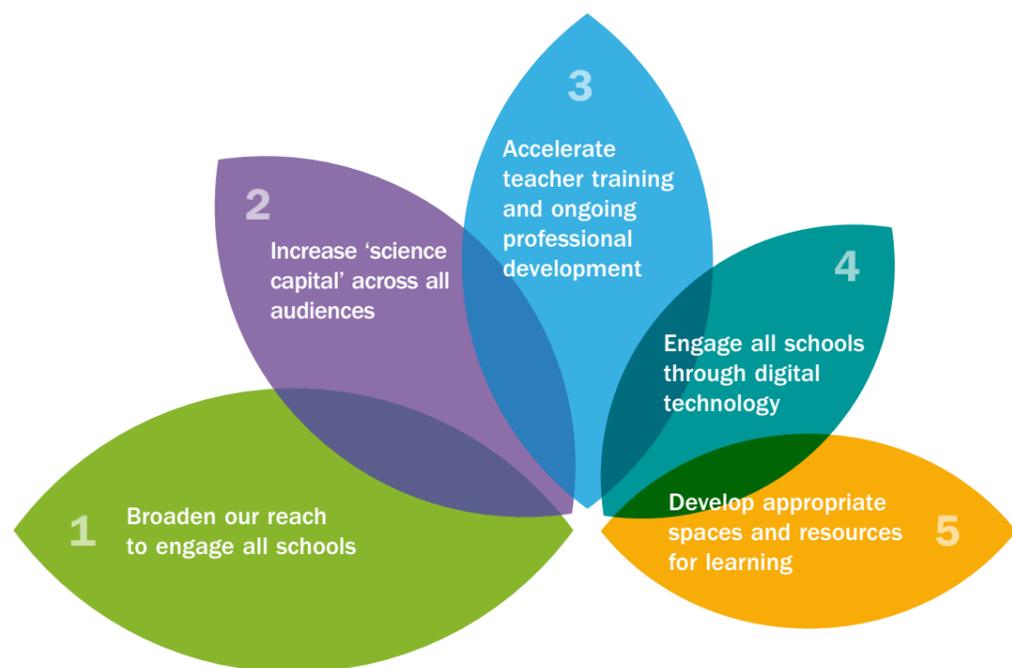
¹ 'RBG Kew', 'Kew', 'we' and 'our' refer to the whole institution of the Royal Botanic Gardens, Kew, based at three sites: Kew Gardens and Wakehurst in the UK, and the Kew Madagascar Conservation Centre in Antananarivo. 'Kew Gardens' refers specifically to the Kew Gardens (London) site.

Our five priorities for learning

RBG Kew has published several strategies to guide its work during the forthcoming decade. At the forefront of these is the corporate strategy, 'Our manifesto for change 2021–2030', to focus our work on addressing the urgent global extinction and climate crisesⁱⁱⁱ. Our aspiration is to end biodiversity loss and to help create a world where nature is protected, valued by all and managed sustainably.

Education is vital to fulfilling this aspiration and delivering on our mission. Among five priorities we lay out in our corporate strategy is a commitment to 'train the next generation of experts' by 'developing new learning centres at Kew Gardens and Wakehurst', and providing 'excellent digital resources and training programmes for schoolchildren, students and teachers'. These ambitions are explored in detail in this 'Schools Learning Strategy 2019–2024' under Priorities 5 (page 32) and 4 (page 26), respectively.

Our five priorities for developing our schools learning programme are:



Meanwhile, in our 'Outreach Strategy 2022–2027: Connecting and engaging communities to protect nature together', we outline our ambitions to strengthen our relationships with people who are young, disabled, and/or from ethnic minority or lower socio-economic backgrounds. Of particular relevance to this Schools Learning Strategy 2019–2024 are the outreach goals of 'connecting children with science and nature' and 'nurturing tomorrow's environmental leaders'. We expand on these ambitions under Priorities 1 (page 10), 2 (page 16) and 4 (page 26). In all our endeavours, we will strive to ensure that RBG Kew is 'for everyone'.

Priority 1

Broaden our reach to engage all schools

We will increase our engagement with secondary schools to influence more pupils to take 'triple science' at GCSE level and 'science' at A level. We will also expand the numbers of pupils from disadvantaged backgrounds who visit our sites and assets.

Priority 2

Increase 'science capital' across all audiences

We will put science at the heart of teaching, making it meaningful and relevant to pupils' everyday lives. RBG Kew teachers will focus on increasing science capital and Inquiry-Based Science Education to achieve this.

Priority 3

Accelerate teacher training and ongoing professional development

We need brilliant teachers to help us inspire new eco-advocates. We will actively forge new partnerships with universities to expand our Initial Teacher Training offer, and we will develop our Continuing Professional Development module to reach science-subject leaders and career-entry teachers in primary schools across the UK.

Priority 4

Engage all schools through digital technology

We will expand and extend our successful Endeavour learning platform to reach wider audiences, and inspire new connections, conversations and thinking focused on plant and fungal science education.

Priority 5

Develop appropriate spaces and resources for learning

We will build a state-of-the-art learning centre at Kew Gardens, and develop Wakehurst's Walled Garden as a new educational hub.



Priority 1: Broaden our reach to engage all schools

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- Increase secondary school engagement with a focus on influencing more pupils to take triple science at GCSE level and science subjects at A level
- Engage increasing numbers of pupils and teachers from disadvantaged areas

Many of the challenges facing society – from climate change to biodiversity loss and plastic waste – require workers qualified in science, technology, engineering and mathematics (STEM) subjects. Currently, secondary school pupils interested in science can take either 'double science', where the study of physics, biology and chemistry is combined into two GCSEs, or 'triple science', where they gain a separate GCSE in each subject. The triple science stream has been championed by industry and the government alike as a means to access a STEM career. However, only around 25% of pupils² opt to take triple science^{iv}.

A visit to Kew Gardens or Wakehurst can support teaching of many aspects of the triple science coursework. For example, GCSE biology calls for study of photosynthesis, how plants reproduce, evolution, how pathogens spread, the development of medicine, genetics, and the role of biotechnology in underpinning food security. Not only do we have world-class

living and preserved collections of plants and fungi we can use to engage pupils with these themes, we employ qualified teachers and have the benefit of vast outdoor botanical classrooms. Actively encouraging more secondary schools to access these unique assets gives us the opportunity to nudge more pupils to take triple science at GCSE level, to continue on to take science A levels and, ultimately, to pursue STEM-based careers.

It is vital that such opportunities are afforded to all. However, schools serving pupils from more disadvantaged backgrounds are less likely to offer triple science than schools serving pupils from more affluent backgrounds, and more disadvantaged pupils are less likely to take the subject even if it is offered^v. Moreover, a higher proportion of pupils who take triple science take science subjects at A level – possibly because of a perception that those who take double science are not sufficiently clever to take science A levels. This means fewer pupils from disadvantaged backgrounds take A levels in science subjects and gain access to STEM-based jobs as a result. Not only is this inequitable, it restricts the pool of students entering STEM careers^{vi}.

² At state-funded mainstream schools in 2016.





By proactively encouraging visits from secondary schools located in more disadvantaged areas, we can support those schools to offer triple science, encourage more pupils to take that option, and help guide all science-minded pupils – whether studying double or triple science – to consider taking A level science. We aim to do this using ‘Pupil Premium’ payments (Box 2) as a measure of the number of pupils from disadvantaged backgrounds visiting RBG Kew sites.

Before the pandemic, as we began delivering on our Schools Learning Strategy, the number of secondary-school pupils visiting Kew Gardens rose by 7,000: from 29,188 in 2018–2019, to 36,274 during 2019–2020. As we get back on track, post COVID-19, the hope is to build on these gains, helping to ensure STEM-based careers are available to all.

BOX 2:

What is Pupil Premium?

Each year, the government provides funding to improve outcomes for disadvantaged pupils attending schools in England. Called Pupil Premium (PPr), it ranges from £310 per pupil per school year for children from service families, to £2,345 per pupil per school year for children in care. Provision of the grants is based on research showing that children from low-income families fare less well at school than their peers. Children who qualify for PPr often face challenges such as having poor language and communication skills, low confidence, or issues with punctuality and attendance^{vii}. Currently, 62% of schools visiting Kew Gardens measure PPr³, of which 55% have a PPr of above 20%, and 32% have a PPr of above 35%⁴.

The aim with PPr is to provide targeted help for pupils to reduce the learning gap between them and other children. Schools can choose how they spend the money, as they are best placed to identify the support that would most likely benefit eligible pupils. They might use it, for example, to provide extra one-to-one or small-group support for children within the classroom; employ additional teaching assistants; run supplementary before- or after-school classes in maths or literacy; provide extra tuition for gifted children; fund music lessons; or pay for educational visits – to attractions such as Kew Gardens and Wakehurst.

To deliver on Priority 1, we will:

- Increase the number of schools with high Pupil Premium (PPr) that visit RBG Kew sites, through offering bursaries. We shall provide 15 bursaries per year to schools with >35% PPr visiting Kew Gardens and a further 30 annually to schools with >20% PPr visiting Wakehurst.
- Increase the number of RBG Kew teacher-led visits at Key Stage (KS) 4 and KS 5, to both Kew Gardens and Wakehurst, from 2,500 to 12,000 per year by 2030.
- Develop and implement a five-year training plan for Kew teachers, to provide Continuing Professional Development (Priority 3 on page 22) and ensure the highest quality of teaching for visiting schools.

³ The remaining 38% includes independent schools, overseas schools and home educators.

⁴ Data from visits to Kew Gardens during 2018–2019.

‘Education does not change the world. Education changes people. People change the world.’

Paulo Freire, educator and philosopher



Priority 2: Increase 'science capital' across all audiences

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- Put science at the heart of teaching, and make it meaningful and relevant to pupils' everyday lives
- Nurture Inquiry-Based Science Education

The children who choose to study sciences at A level are generally those who have become interested in, and feel a connection with, the subject. Often these pupils have a high level of 'science capital', which is defined as having some knowledge of science, thinking of it as a useful or important subject, knowing people within or with connections in the field, and readily engaging with science on a day-to-day basis (Box 3). In contrast, pupils with a lower level of science capital are less likely to engage with and choose careers in science.

A survey of 3,658 secondary school students aged between 11 and 15 years in England found a wide disparity in the spread of science capital across the student population, with just 5% having high science capital and 27% having low science capital. Further analysis revealed that pupils' rankings as having high, medium or low science capital were clearly linked to cultural capital, gender, ethnicity and the set or track in which they were placed at school for science. Of pupils who said they did not want to study any science after GCSE, 34% were deemed to have low science capital; only 2% of high-science-capital pupils responded this way^{viii}.

To increase the number of pupils taking science subjects at GCSE and beyond, building science capital across all audiences must be a priority. With this outcome in mind, RBG Kew took part in the Science Capital in Practice initiative. This was a collaboration between the Science Museum and the UK Association for Science and Discovery Centres. We were one of 15 UK science museums and centres that worked together to develop a 'community of good practice' for increasing diversity and inclusion in science by applying a science capital-informed approach.

In taking part in such initiatives, our aim is to provide up-to-date training for Kew teachers and to embed the most pertinent elements of science capital-oriented thinking in our education sessions and online resources. These elements include: science literacy; the promotion of attitudes and values required for science to be inclusive; communicating about people in science-related jobs; and encouraging pupils to talk to others about science. To date, our work in this regard has reached over 30,000 pupils. In 2022, we also launched a citizen-science programme that will help to build pupils' science capital at the same time as revealing insights into how nature benefits schoolchildren (Box 4, overleaf).

BOX 3: What is science capital?

Science capital is a relatively new term that takes the concepts of social and cultural capital, introduced by the French sociologist Pierre Bourdieu, and applies them to science. Social capital is value derived from social networks, such as having good relationships with neighbours. And cultural capital is value gained from being part of a social class (such as particular skills, knowledge, tastes and mannerisms)^{ix}.

Similarly, science capital can be defined as value that comes from a person's knowledge, attitudes, experiences and contacts related to science. It can be gained, for example, from having parents who work in scientific jobs or who regularly organise outings to science-based attractions for days out, or from having access to scientific magazines. The strength of a person's social, cultural and science capital has the potential to make them feel included or excluded from particular groups. The more science capital a pupil has, the more likely they are to engage with science and aspire to embarking on a science-related career^x.

BOX 4:

Finding out whether nature is good for us

Is a biodiverse or barren landscape better for our wellbeing? RBG Kew researchers aim to answer this question through a new study into how schoolchildren react to and engage with biodiverse habitats at Wakehurst. One thousand students, from schools that do not usually visit the West Sussex site, are taking part in the study during 2022. The project will run initially for one year but the hope is to extend it to five years, with the same students taking part throughout. Wakehurst is well placed for this kind of study, comprising 535 acres (216 hectares) of rich and varied landscapes.

The study has been designed by Professor Dawn Watling, Director of the Social Development Lab at Royal Holloway, University of London, which is collaborating with RBG Kew on the research. Before visiting Wakehurst, the children will answer questions on their mental health and wellbeing, and on how they usually interact with nature. While at Wakehurst,

they will be observed as they roam, observe and interact with one of three biodiverse habitats: Hanging Meadow in the Loder Valley, Pearcelands Wood, or Westwood Lake and the wetland area.

Immediately following the experience, each child will be asked to draw three pictures – the first representing themselves in a neutral way, the second depicting their response to the Wakehurst landscape, and the third illustrating their usual feelings when they are in a natural landscape. They will also be asked to answer the same set of questions put to them before their visit. And they will be quizzed for a final time two weeks later to see what they recall from their experience. The study will help to shed light on the benefits of spending time in biodiverse environments, and may even determine whether particular habitats are better for our wellbeing than others.



Nurturing Inquiry-Based Science Education

Inquiry-Based Science Education (IBSE; Box 5) goes hand in hand with building science capital. This approach challenges students to explore scientific questions by assessing evidence and applying critical thinking to develop explanations about the natural world. The teacher's role in IBSE is to inspire the children to undertake their own investigations. Kew Gardens and Wakehurst provide immensely stimulating environments in which students can explore science in authentic settings and hone their IBSE skills, building their science capital as they do so. There is potential for RBG Kew to further strengthen IBSE by offering resources for students studying for Extended Project Qualifications (EPQs). Taken in addition to A levels, EPQs provide students with opportunities to develop and extend their skills in planning, research, critical thinking, analysis, evaluation, and presentation. By 2025, we aim to have embedded science capital and IBSE approaches in all schools programmes running on site at Kew Gardens and Wakehurst, as well as online.

BOX 5:

What is Inquiry-Based Science Education in a botanic garden?

Inquiry-Based Science Education (IBSE) is an interactive and participatory approach to teaching and learning, rooted in constructivist theories of how people learn. It provides pupils with opportunities to connect their existing knowledge and ideas with new concepts, in a way that furthers their scientific knowledge and understanding. IBSE encourages pupils to grapple with scientific problems and undertake scientific enquiry – where they make observations, ask questions, examine information sources to understand the current state of knowledge, conduct experiments, interpret data, review knowledge in the light of their findings and communicate results. In a botanic garden, pupils can observe and investigate real-world scientific concepts and phenomena – such as pollination and evolution – that are difficult, if not impossible, to replicate in school. They can also meet professional scientists and learn about their work. Effective IBSE in a botanic garden helps to develop pupils' critical- and independent-thinking skills, while increasing their motivation and passion for science.

To deliver on Priority 2, we will:

- Ensure all on-site teaching sessions link to the work of Kew Science or Horticulture.
- Initiate annual on-site school science days for secondary schools – to increase the visibility of Kew's scientists and horticulturists, and provide opportunities for pupils to learn about careers in plant and fungal science.
- Review all teaching sessions on site and online to provide opportunities for pupils to take responsibility for establishing the direction and methods of their inquiry.
- Establish an online resource bank with ideas for pupils wanting to study for an EPQ in plant or fungal science.



'Science and everyday life cannot and should not be separated.'

Rosalind Franklin, chemist, molecular biologist and one of the key figures behind unlocking the structure of human DNA



Priority 3: Accelerate teacher training and ongoing professional development

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Accelerate teacher training and ongoing professional development

- [Expand our Initial Teacher Training offer through partnerships with more universities](#)
- [Develop our Continuing Professional Development module to reach those teachers responsible for leading science and geography subjects in primary schools across the UK](#)

England has a severe shortage of science teachers, with scientists more likely than their peers to leave the profession. A 2017 report commissioned by Wellcome and carried out by Education Datalab found that the odds of

newly qualified science teachers (in state-funded secondary schools) leaving the profession within the first five years was 20% higher than for their non-scientist equivalents. The report also found that teachers who attended National STEM Learning Network courses were more likely to remain in the profession. The likelihood for a teacher still being in the profession a year after receiving training was 160% higher than for those who had not done soⁱⁱ.

As well as encouraging teachers to remain in the profession, training can play a crucial role in improving the quality of their teaching. A 2020 report by the Education Policy Institute found that high-quality Continuing Professional Development (CPD; Box 6, overleaf) for teachers had a significant effect on pupils' learning outcomes.



Specifically, CPD had the potential to help close the gap between pupils' attainments under career-entry teachers and those with a decade of experience. The report found CPD to have a greater effect on pupil attainment than other potential actions, including paying teachers according to performance and lengthening the school day^{xii}.

RBG Kew has the potential to help resolve the current shortage of science educators, and encourage teachers to bring more students to Kew Gardens and Wakehurst, by providing innovative CPD and Initial Teacher Training (ITT; Box 6) courses in plant and fungal science. In the past, we have delivered teacher training programmes by working in partnership with universities and responding to their needs (Box 7). In future we aim to strengthen these relationships, build new ones and proactively provide new resources for CPD and ITT. Initially, training will be offered at the Kew Gardens and Wakehurst sites but, in time, we hope to also provide outreach packages for school in-house training days.

BOX 6:

Training for teachers explained

Initial Teacher Training (ITT) is a mandatory qualification for teachers in maintained schools across the UK. Students usually undergo ITT after gaining a degree, such as by taking a Post-Graduate Certificate in Education or through School-Centred Initial Teacher Training. There is also an undergraduate route to ITT, by achieving Qualified Teacher Learning and Skills status. Continuing Professional Development (CPD) learning activities, meanwhile, are those undertaken by teachers to develop and enhance their abilities as their careers progress.

To deliver on Priority 3, we will:

- Increase the number of teachers receiving Continuing Professional Development (CPD) training from 300 to 3,000 by 2030.
- Introduce online CPD training through our Endeavour platform, providing training for over 5,000 teachers by 2030.
- Partner with the STEM National Learning Centre to offer teacher training in plant and fungal science.



- Establish an annual day for Initial Teacher Training providers in London and the south-east (such as the Institute of Education at University College London, King's College London, and Roehampton University) to share opportunities for teacher training at Kew Gardens.

BOX 7:

A special place to help students excel at teaching

Joanna Nicholl, Post-Graduate Certificate in Education Science Educator at University College London (UCL), has been bringing groups of trainee teachers to Kew Gardens for several years. The groups come for three days: on the first day they receive training from both RBG Kew and UCL teachers, then they lead their own sessions for the other two days. There are two aims: to train the teachers to educate children in an outdoor environment, and to support them to gain knowledge on subjects they might not know much about, such as how plants have evolved and adapted to their surroundings over millions of years.

'The trainee teachers I teach who come from chemistry and physics backgrounds are often less confident with these topics, since they sometimes feel there is too much of a biology focus,' says Joanna. 'But then they realise there are opportunities for chemists or physicists to look at how amazing this stuff is through a physics or chemistry lens. From my point of view as a biologist, the flora and fauna that Kew has, the sheer level of biodiversity, the richness of the different environments, the experts, the research, and the narratives that go along with that research [make it] so special.'



'All of education should be about thinking and problem solving of different kinds. It doesn't have to be about what you know. It's about what you can know.'

Nergis Mavalvala, Marble Professor of Astrophysics, Massachusetts Institute of Technology

Priority 4: Engage all schools through digital technology



Priority 4: Engage all schools through digital technology

- Reach wider audiences
- Inspire new connections, conversations and thinking focused on plant-science education

RBG Kew's Endeavour learning platform enables teachers and pupils to go behind the scenes at Kew Gardens and Wakehurst without leaving their classrooms. Established in 2018 to bring our science to young people who are unable to physically visit, the online initiative has been signed up to by over 5,900 teachers. This means around 177,000 pupils are currently learning first-hand about Kew's vital work on themes from the use of DNA to classify plants, to the work of modern-day plant hunters.

The platform provides resources for teaching pupils from KS 1–5, spanning children in primary schools to teenagers taking A levels. Designed to be interactive, the free-to-access platform includes lesson guides, infographics, quizzes and competitions, plus video clips of our experts at work (Box 8). The topics encompass broad themes such as biodiversity and climate change, and focus on specific projects – including RBG Kew's Plant and Fungal Trees of Life project, which involves analysing DNA from plant and fungal genera to piece together their evolutionary relationships.

Our aim is to reach every school in the country and inspire new connections, conversations and thinking focused on plant-science education. Social media will support us to do this by enabling RBG Kew experts to share content quickly, participate in discussions and create a community of practitioners.

We also intend to develop initiatives that engage people online initially and then trigger local activity (such as visits to other botanical gardens). This is similar to the model of RBG Kew's Grow Wild initiative, an outreach programme that nurtures community projects based around wildflowers and fungi. One new scheme is our Kew Young Environmental Leader Award (YELA), which is designed to steer young people to becoming environmental leaders and driving change in their communities (Box 9, overleaf).

While Endeavour will remain the main platform through which RBG Kew interacts with schools, we will also provide resources on the learning pages of our website, kew.org.

BOX 8:

Taking the Endeavour plant-health challenge

The Endeavour platform presents a number of 'challenges' for KS 4 and KS 5 students to undertake, requiring them to apply their scientific knowledge to real-life issues. Each one comes complete with an overview of the topic, links to curricula, guidance on how teachers can run the challenge, and a detailed lesson plan. Every year, RBG Kew offers a £1,000 prize for the best piece of work submitted in response to each challenge.

An example is the KS 4 challenge on plant diseases. Pupils first watch a short video presented by Owen Blake, RBG Kew's UK Ash Collecting Project Officer. He explains how ash trees are dying from ash dieback disease and how RBG Kew is gathering seeds and tissue samples from specimens that appear resistant to the disease, in the hope of finding ways to conserve the species.

He then sets pupils the challenge of designing and completing a plant-health investigation in their local area, and writing a report about their findings.

'We provide an online identification guide for common plant diseases and information on sampling strategies to support the students,' explains Kate Graham, Schools Learning and Content Manager at RBG Kew. 'There is also a "top trumps" game that the pupils can play, in which plant attackers are pitched against defenders. With this and all the challenges, there is quite a lot of "ownership" with the learning, and it is inquiry-based in that students test out their own theories, make their own decisions and justify them.'



BOX 9:**Motivating young people to become environmental leaders**

RBG Kew is nurturing a new generation of environmental leaders through its Kew Young Environmental Leader Award (YELA). Launched in 2022, the award is designed to motivate young people to develop their leadership capabilities so they can inspire a passion for the natural world in others and drive environmental change in their communities. To be awarded, participants must run, document and submit evidence for an environmental project of their choosing.

Students must first identify a suitable project and an organisation that can support them to run it. For example, they might initiate a seed-swap scheme to encourage people to grow plants as part of a class project. Or they could work in their own time, with support from their youth club, to devise a plan to establish a wildlife corridor. As they carry out their individual projects, the students must gather evidence to demonstrate their leadership abilities in the dimensions of: environmental vision; planning; creativity; perseverance; adaptability; teamwork; diversity and inclusion; communication; and self-reflection.

Getting involved

Students wishing to participate register online and gain access to resources including a series of pamphlets, outlining each leadership dimension, which steer them through the awards process. Supporting organisations check the work to ensure students have met the criteria and included all the required information before they submit their entries to RBG Kew for evaluation. Successful students receive their YELA from RBG Kew within two months of submitting their evidence portfolios.

Supporting organisations are encouraged to celebrate their students' achievements in a way that suits them, such as by holding a presentation ceremony, mentioning them in assembly or highlighting their achievements in a community or youth-group newsletter.

We will drive traffic to both these portals by alerting teachers through half-termly newsletters, and by showcasing our schools' offerings on social media. We will also create marketing packs, highlighting resources such as YELA, for handing out to visiting schools.

Embracing online life

The time is ripe for engaging more schools through digital means. Not only are pupils' home lives often immersed in technology, many schools that were forced by the pandemic to take teaching online are retaining an element of digital learning in their provision of education. A recent YouGov survey found that school leaders were adopting locally appropriate and flexible remote programmes for pupils, staff and parents. Among teachers surveyed, 75% (primary school) and 69% (secondary school) reported using links to external websites and resources^{xiii}.

The 'Using Digital Technology to Improve Learning' guidance report, published by the Education Endowment Foundation, notes that, to date, technology has been most effective when used to supplement or enhance teaching rather than replace it. The study reported that evaluations of some more complex ways of using technology to improve explanations and modelling show promise, particularly in STEM subjects. For example, approaches using interactive simulations had, on average, been found to improve learning^{xiv}.

RBG Kew has established the largest on-site schools programme globally delivered by a botanic garden. As teachers negotiate the new post-COVID learning landscape, there is great potential for us to also become the leading provider of online learning in botanical and fungal science. Expanding our digital assets will support us to deliver on our associated priority of expanding science capital. In the long-term, we can use these digital resources and capabilities to disseminate our important scientific messages to schools globally.

To deliver on Priority 4, we will:

- Increase the number of teachers registering on Endeavour from 6,000 to 15,000 by 2030, with a focus on attracting schools in the north of England and in Scotland, Wales and Northern Ireland.
- Use Endeavour to promote the Kew Young Environmental Leader Award, encouraging at least 350 pupils to register by 2027.
- Create livestream videos with RBG Kew scientists and partners working in different countries around the world, enabling pupils to discover about *in situ* plant-science research and conservation.
- Establish a social media presence for schools learning at Kew, attracting at least 15,000 sign-ups by 2030, and promote online conversations around plant- and fungal-science education.

'There is a powerful force unleashed when young people resolve to make a change.'

Jane Goodall, primatologist and anthropologist





Priority 5: Develop appropriate spaces and resources for learning

Priority 5:

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- **Construct a state-of-the-art learning centre at Kew Gardens to support delivery of the priorities outlined in this Strategy**
- **Develop Wakehurst's Walled Garden as a new educational hub**

Our long-term vision is for RBG Kew to be recognised nationally and internationally as the 'gold standard' for schools learning in plant and fungal science. So, it is vital we have first-class equipment and facilities that can support pupils and teachers to get the most from visits to our sites. RBG Kew therefore plans to construct new, state-of-the-art educational centres at both Kew Gardens and Wakehurst.

At Kew Gardens, we will build a new learning centre on the site currently occupied by White Peaks. The new centre will house seven formal teaching spaces for students of all ages, offices for the Kew Gardens learning team, a gallery for exhibits and learning materials, and spaces for outdoor learning. As part of RBG Kew's goal of becoming carbon positive by 2030, the building will be constructed to meet Passivhaus Plus and BREEAM Outstanding standards, and to achieve whole-life zero carbon (Box 10, overleaf).

Plans are also in progress to redevelop the Walled Garden at Wakehurst to become a science, horticulture and education hub, which can also help to direct general visitors to other parts of the site. It will include a new education centre with four classrooms and two laboratories. These will be complemented by a learning garden and glasshouse, where RBG Kew experts can bring plant science to life for young visitors. The Walled Garden was historically used as a kitchen garden, so the overarching theme of food will provide a natural route to engaging visitors with nature, plants and fungi.

RBG Kew provides learning opportunities for students, teachers, families and more at both its sites, with learning primarily taking place outdoors. The new buildings will enable the offer of indoor activities – from extracting genes of plants and fungi, to the study of objects, teacher training, and 'messy' nature workshops – and provide secure, safeguarded spaces for learning. These bespoke new venues will directly support RBG Kew's aims to significantly increase KS 3, KS 4 and KS 5 visitors, and expand its ITT and CPD training programmes across both sites.

'We are tied to the land – the trees and animals and soil and water – and to one another, and ... we have a responsibility to care for these connections and resources, ensuring the sustainability of these ecosystems for future generations and to honor those who came before ...'

Suzanne Simard, Professor of Forest Ecology, University of British Columbia

**BOX 10:****Setting high ecological standards**

The new learning centre at Kew Gardens will have first-class ecological credentials. RGB Kew has commissioned Hazle McCormack Young LLP to design and deliver a building that will achieve Passivhaus Plus, BREEAM Outstanding and whole-life zero-carbon ratings. These standards cover energy efficiency, sustainability and carbon use. As well as helping us to achieve our ambitions around schools learning, creating a building with the highest environmental credentials will enable us to meet our Manifesto priority to: 'influence national and international opinion and policy'.

The Passivhaus rating system is a voluntary standard for energy efficiency that reduces a building's ecological footprint. This is achieved through features such as airtight construction, high-quality insulation and mechanical ventilation with heat recovery. Buildings that achieve the Passivhaus Plus rating not only use far less energy than those built conventionally but they also produce as much energy as their occupants consume.

The BREEAM system rates a building's level of sustainability. Buildings achieve a score according to their performance around water use, pollution, materials, health and wellbeing, land use and ecology, innovation and more. A BREEAM Outstanding rating is currently achieved by less than 1% of new non-domestic buildings in the UK. Buildings that are ranked as BREEAM Outstanding are extraordinary and highly innovative.

Achieving 'whole life zero carbon' demands that the carbon embedded in the building's materials and construction, as well as carbon generated by its use, will be paid back in energy created by the building over 75 years of service. To meet this need, the learning centre will be timber-framed, with brick cladding made from 90% recycled content.

To deliver on Priority 5, we will:

- Work with the commissioned architects and project team to deliver, by 2025, an extraordinary whole-life zero carbon learning centre at Kew Gardens, with Passivhaus Plus and BREEAM Outstanding ratings.
- Create outdoor learning spaces providing hands-on opportunities for school pupils to connect with nature.
- Create a permanent, multifunctional space at Kew Gardens suitable for hosting 250 school pupils to eat lunch, and which can be used by other teams outside of term time.
- Work with the commissioned architects and project team to redevelop the Walled Garden at Wakehurst to become a science, horticulture and education hub.

'Students should not leave school only able to identify two or three plants but should retain the knowledge of the ecological importance of plants to develop a species literacy, particularly the role of plants in solving modern societal challenges'

Sebastian Stroud, et al., 'The botanical education extinction and the fall of plant awareness', 2022



Why RBG Kew is a unique learning resource

Tackling the diverse environmental issues that humanity currently faces calls for talented, engaged and well-trained scientists. While school teaching of basic scientific principles is fundamental, so too are ‘eureka moments’ in pupils’ lives, where science comes alive and is made truly relevant to them. This is where RBG Kew has the potential to make a real difference.

Kew Gardens and Wakehurst are living laboratories. By using well-known plants and fungi as entry points – tea, coffee, fruits, bamboo, mushrooms and so on – students can explore scientific themes such as photosynthesis, evolution and genetics in a stimulating setting with scientists. Where better to demonstrate to pupils the value of science than at an institution where more than 350 scientists are working to help resolve the existential challenges of climate change and biodiversity loss?

The assets RBG Kew has to help with this are immense. The plants growing in its gardens alone represent 27,000 species, subspecies and varieties. Then there is the Herbarium, containing around 7,000,000 pressed plants and the 75,000-strong spirit collection; the Fungarium, holding around 1,250,000 dried fungi; the Seed Collection of some 90,000 living seed accessions; the DNA and Tissue Bank, with 60,000 DNA and plant-tissue samples; and the Economic Botany Collection of 100,000 plant raw materials and products. Added to this are RBG Kew’s historic and state-of-the-art buildings, and its library and archives, containing around 500,000 items spanning 2,000 years of plant knowledge. These collections hold a wealth of data, much of which is waiting to be unlocked by the next generation of researchers.

The new learning centre at Kew Gardens and educational hub at Wakehurst will add bespoke places in which to nurture this new generation of expert scientists. The new laboratories, galleries and classrooms will be stimulating spaces in which pupils can unleash their powers of enquiry and seek to answer their own scientific questions about the natural world, in a way that is similar to professional researchers. And helping them to do so will be RBG Kew’s greatest assets of all: its teachers, horticulturists and scientists who are ready and waiting to inspire new plant and fungal champions.

We realise, of course, that not everyone is able to visit Kew Gardens and Wakehurst in person. With curricula packed and teaching time limited – particularly at KS 4 – leaving the classroom can be a challenge. This is why we are expanding the resources we make available online, and striving to stimulate new virtual connections and networks. With blended education becoming more common, we have an unprecedented opportunity to reach every school in the country and, ultimately, to help pupils around the world unravel the mysteries of plant and fungal science.

‘Our aim is for our schools learning programme to be recognised as the gold standard for schools learning in plant and fungal science.’

RBG Kew

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