Oxford Instruments have recently partaken in a new STEM outreach project, developed to give students hands-on experience of STEM research. Originally conceived by Dr Alex Ball of the Natural History Museum (NHM), London, and Dr James Perkins of Queen Elizabeth Grammar School in Kent, the project has proved remarkably popular with a diverse range of students across the UK. As an industry leading manufacturer of a broad range of scientific equipment, Oxford Instruments were uniquely positioned to contribute both apparatus and expertise to the project.

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As an industry leading manufacturer of a broad range of scientific equipment, Oxford Instruments have been working on for a number of years. They then joined with Hitachi to set it up. Finally, teachers are given remote training on how to get up and running on the microscopes. Those teachers then train the school students, some of whom become expert users and train other people.

Throughout the loan, the school has support from IRIS and the NHM for the projects they’re running. As part of the microscope loan, they’re also provided with a few bits of sample preparation equipment needed to put samples into the microscope, for example, specimen stubs. Then they do their project! Some schools do additional outreach projects and some schools link with other schools in the area to remotely access the microscopes. When it's all done, the microscope is packed up and collected, ready for the next school. So, it’s quite an involved project for everyone, but it’s proven to be immensely powerful.

The STEM Education Project

Giving UK students hands-on experience of scientific research

Oxford Instruments have recently partaken in a new STEM outreach project, developed to give students hands-on experience of STEM research. Originally conceived by Dr Alex Ball of the Natural History Museum (NHM), London, and Dr James Perkins of Queen Elizabeth Grammar School in Kent, the project has proved remarkably popular with a diverse range of students across the UK. As an industry leading manufacturer of a broad range of scientific equipment, Oxford Instruments were uniquely positioned to contribute both apparatus and expertise to the project.

We spoke to Christian and Louise about the remarkable creative uses the students found for these devices. We also spoke of the vital importance of STEM outreach for students, both for inspiring the next generation of researchers and ensuring diverse representation within STEM industries. Oxford Instruments now anticipate the continued success of the project, as new cohorts of students from schools across the UK prepare their applications.

Could you give us an introduction to the history of Oxford Instruments?

Christian: Oxford Instruments is the first commercially successful spin-out company of Oxford University. Originally, Oxford Instruments was set up by Sir Martin Wood and Lady Audrey Wood to commercialise superconducting magnets that were developed in the Department of Physics. Since then, it has developed into a scientific instrumentation company with a specific focus on microscopy and nanotechnology. Oxford Instruments NanoAnalysis makes detectors for electron microscopy and this is how we got involved in the project, to make electron microscopy accessible to students.

In which areas are the products and services of Oxford Instruments currently being used?

Christian: They are mainly used in academic, scientific, and industrial research. Our core purpose is to support our customers to address some of the world’s most pressing challenges, enabling a greener economy, increased connectivity, improved health, and leaps in scientific understanding. People use Oxford Instruments products to develop new, lighter, and smarter materials for the semiconductor industry, as well as for renewable energy generation and batteries, such as new lithium-ion batteries for energy storage. These are all areas that we have been closely involved with.

Where did the idea for the STEM Education Project originate?

Louise: The project was originally proposed by Dr Alex Ball of the Natural History Museum (NHM) and Dr James Perkins of Queen Elizabeth Grammar School in Kent. It’s an idea they had been working on for a number of years. They then joined with Hitachi High

Thought Leader

Dr Louise Hughes, Business Manager for the life sciences market.

Students at the Anthony Gell School in Derbyshire look at results from their microscope surveys. Credit: Alex Hyde.

Schools have been incredibly inventive in how they’ve used the microscope.

Technologies America’s Inspire STEM Education Outreach Program, which is what kicked everything off.

What exactly does the project involve?

Louise: One of the great things about this project is that it shows when different institutions get together something really special can occur. The project is a brilliant example of collaboration between several institutes. Other collaborative partners include a charity called Institute for Research in Schools (IRIS), which has been crucial as the point of contact for schools that want to partake in this project. Additionally, we partner with the Royal Microscopical Society (RMS), which helps coordinate the programme and organise some of the logistical aspects, such as moving the microscopes between different schools. The two microscopes are usually loaned to different schools for six months or so. The microscopes are often loaned to different schools for several weeks, but the timeframe varies between schools. The two microscopes are then shipped to different schools. Once they arrive at the school, staff are given support for how to unpack the microscope and set it up. Finally, teachers are given remote training on how to get up and running on the microscopes. Those teachers then train the school students, some of whom become expert users and train other people.

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How do the schools access the microscopes? Christian and Louise outlined the different aspects of a school’s involvement.

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We've just had a load of new applications for next year coming through. So, it's all very exciting.

Could you explain a little about the AZtecLive One Xplore energy dispersive X-ray system?

Louise: This is a brilliant detector. It is great for the type of microscopes the schools have, which are tabletop electron microscopes; they’re portable, which is ideal. The key point about this detector is the software that it is run through. The software has been deliberately designed to be incredibly easy to use. The interface means you don’t need expert knowledge about energy dispersive X-ray spectrometry. It’s very simple ‘clicks’ to go through a workflow. Very quickly you’ll start getting results. There’s a lot of stuff built into the background to make sure that the users get accurate and meaningful results, without needing to have much knowledge ahead of time. It’s brilliant for exactly this type of application. Students and new users can start getting the results within minutes of the system being turned on. It’s ideal for the environment inside schools with multiple users.

How did the schools use the scanning electron microscopes during the project?

Louise: Schools have been incredibly inventive in how they’ve used the microscope. They’ve run proper research projects via IRIS. One of them has been on ‘how vegan is flour?’ The students were looking for traces of insects, which may have been introduced into the flour during the milling process. Apparently, it’s quite easy to identify insect parts! They have also looked at the chemical composition of particles of dust on plants. So, taking samples of plants from roadsides and looking at what type of materials get deposited on leaves in urban areas. They’ve also undertaken projects looking at adaptations of insects in different environments, such as aquatic environments. They are all projects that don’t require a huge amount of sample preparation (because schools don’t have that equipment!) but that are suitable for the high-resolution microscope imaging and the analytical capabilities of our detector.

Schools have also been using these projects to help A-level students achieve CREST Awards. CREST Awards is a scheme designed to help students think and behave like scientists and engineers. As well as being part of the school’s normal curriculum, the schools use these projects to help students apply for these awards. Schools have taken the microscope and run really big outreach events. One of the schools took a microscope to a weekend event and had interactions with over 700 people in one day, which is just incredible! They’ve also been doing cross-disciplinary, collaborative projects: art-science crossover projects, writing about experiences on the microscope, using the images to inspire artworks, or using the microscope to look at art and textiles. Schools have been really inventive in how they’ve used these microscopes. It’s amazing how many students have been able to interact with this technology and engage with STEM subjects – because it’s not just biology and life science, it’s all areas of STEM they’ve been able to experience in this project.

How do you take new cohorts, and what’s the plan for the summer?

Louise: You have to submit a detailed application form and talk about how many students are going to be using it, the duration you want it for and then the users get accurate and meaningful results, without needing to have much knowledge ahead of time. It’s brilliant for exactly this type of application. Students and new users can start getting the results within minutes of the system being turned on. It’s ideal for the environment inside schools with multiple users.

When did the project start?

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Louise: The project was delayed initially because of lockdown and the logistics surrounding lockdown. It started in 2020 and the initial pilot ran until the summer of 2021. They had the first cohort of schools up until summer last year, and then the new round from September onwards. We’ve just had a load of new applications for next year coming through. So, it’s all very exciting.

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Students were fascinated by the hidden worlds they exposed through the lens of their microscope. Credit: Kate Bellis.