



THE INSTITUTE
for RESEARCH
in Schools

Summary of IRIS projects

Physics:

CERN@school

- Radiation and particle detectors – called Timepix and based on CERN technology – are available for loan to schools.
- Schools use the detector to support teaching radiation and particle physics topics. It provides a visual display of the radiation encountered and greatly enhances understanding in these areas. Starter experiments are provided to schools.
- Whilst in school the detector is also used as the basis of a research project. Students set a research question and design a set of experiments in order to investigate.
- Data taken with these detectors is shared via an online platform: Timepix Analysis Platform At School (TAPAS). Developed by an IRIS student as part of his Extended Project Qualification, this allows schools to share data and receive a detailed analysis of their measurements.

TimPix

- The same detector technology that is used as part of the CERN@school project is on board the International Space Station (ISS). Our partners at the University of Houston have made this data available to our schools for analysis.
- Starter activities introduce students to the data format and encourage them to investigate the science underpinning the measurements. As part of this project students develop their data analysis and communication skills.
- A variety of aspects have been investigated, including the South Atlantic Anomaly and how it changes over time, students have compared measurements on the ISS with the behaviour of the Sun and have also made comparisons with ground-based measurements.

- Their work has been presented at scientific and education conferences in the UK and at CERN and students have received recognition through schemes such as the British Science Association CREST awards.

Higgs Hunters

- Students are working with our partners at the University of Oxford to help analyse data from the ATLAS experiment at the Large Hadron Collider (LHC), CERN.
- Protons are smashed together at the LHC at close to the speed of light. In July 2012 scientists at CERN announced they had found evidence for the Higgs boson, confirming a theory about how particles gain mass.
- The dataset provided as part of the Higgs Hunters project could contain evidence for new particles that exist for a very short time following the production of a Higgs boson.
- Working with a large volume of data means that students have to be able to filter and prioritise to identify potential candidates.

Biology:

Genome Decoders

- A collaboration with the Wellcome Sanger Institute, Wormbase and European Bioinformatics Institute
- Annotation of the entire DNA of the Human Whipworm which is a major cause of one the worst Neglected Tropical Diseases which affects millions in a large number of countries, and especially children, preventing them from going to school, and essentially trapping them in a poverty cycle that only supports the ongoing threat if illness and possible death from the effects.
- Students use the same software as the scientists at the Sanger to investigate and annotate the genes.
- This is the first end to end mapping of a whipworm and could lead to the develop of vaccines to eradicate or manage the impact.
- All the students participating will be credited on the paper to be written at the end of the analysis.
- This is genuinely a world first, never been done before and would not be possible if it were not for the collaboration with students.

Well World

- Well World is a project based upon the work of Simon Langton Girls' Canterbury (SLG). Over the last five years SLG have worked with Dr Ed Turner (Cambridge University) to develop a project which explores the impact of spending time in biodiverse environments on the physical and mental wellbeing of students.
- Working with the students and teacher at SLG, IRIS has produced a set of resources that enable other schools to start their own investigations into the role their local environment might have on their wellbeing. These resources include a student brochure, a teacher guide and a film now available on the IRIS Youtube site. See www.researchinschools.org
- During the summer term 2018 a small group of schools from across the country (Cornwall, Scotland, Kent, Yorkshire) have piloted the project. It has now been released nationwide for schools to get involved.

Chemistry:

Ionic Liquids

- Ionic Liquids is a partner project recommended by the Institute for Research in Schools (IRIS) and involves the design, synthesis and investigation of ionic liquids.
- Dr. Robert Palgrave at UCL developed this project in collaboration with Sutton Grammar School and Dr. Jess Wade (Imperial College London).
- Ionic liquids are potential 'green' solutions to the global challenge of volatile organic solvents, and may have a large range of other applications such as lubricants for extreme environments (e.g. in spacecraft), with solvents for biomass processing or even a drug delivery method.
- Students will begin by synthesising these ionic liquids in school using a well-established versatile procedure and then investigating their vast and exciting properties and applications.

Environmental Sciences:

MELT (Monitoring the Environment, Learning for Tomorrow)

- Project comprises two sections, each can be followed independently: Carbon Footprint and Earth Observation.
- Carbon calculator allows students to audit their school to calculate their carbon footprint. This forms the baseline data for researching activities to reduce the carbon footprint of the school.
- Earth Observation aspect allows students to engage with scientists and researchers in the analysis of Sentinel-1 data.
- Students analyse images identifying glaciological features and iceberg calving episodes. Information is fed back to scientists at the Centre for Polar Observation and Monitoring.
- Students can bring the two halves of the project together as they consider how human behaviour can impact the climate.

Engineering:

Vertigo

- Vertigo was designed by Jon Sowman and Sutton Grammar School with support from The ERA Foundation and The Institute for Research in Schools.
- Combining accelerometer, gyroscope and GPS data, Vertigo can tell you exactly where it has been and exactly how it's been moving.
- Working inside or outside, there are many uses for a position and orientation logger like this. Including taking it on a rollercoaster.
- Investigate how things are really moving and use your new-found knowledge to engineer an improvement.