

2019–2020

Impact report

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01

Welcome



Unleashing students' passion for science

“What is so important about the IRIS initiative is it gives people a chance to feel that they are attacking a topic where the answer isn't in the back of the book.”

Lord Martin Rees,
Britain's Astronomer Royal and
past president of the Royal Society

Director's introduction



Dr Jo Foster
Director

“
If their education empowers them with the right tools, school-aged students can contribute to the community of scientific research right now.
”

IRIS was founded on the principle of possibility - the belief that young people have the capacity to change the world. If their education empowers them with the right tools, school-aged students can contribute to the community of scientific research right now.

Over the 2019-2020 academic year, we have been reinforcing our foundations, aiming to build a more financially and operationally sustainable organisation. We reviewed existing barriers to schools' involvement and found ways to support students to work more independently. We have invested in a new website and redeveloped our resources to make them easier for students and teachers to use. We now support and celebrate original projects, encouraging students to set off on their own research path.



Director's introduction continued

One of our ambitions for the 2019-2020 academic year was to support students to have their original research published in peer-reviewed publications. IRIS student Lauren Charters has been successful in having her paper published in the Journal of Research in Science and Technological Education, while two further students have submitted their papers for publication to the Journal of Celestial Mechanics and Dynamical Astronomy and the Journal of Geophysical Research.

Covid-19 presented new challenges for IRIS. While it forced us all - the organisation, schools, students - to be more flexible, it did not inhibit young people from carrying out, nor did it diminish their passion for, research. As part of Genome Decoders, students continued working towards their goal, annotating 8,500 genes for the human whipworm. An impressive 180 students took part in our Research in Schools - At Home project.

We developed the Research in Schools - At Home project in response to lockdown. Working with our partners at the Science and Technology Facilities Council, we adapted our Cosmic Mining project to enable more students to get involved with research at home. We promoted it to schools by email, through news media and our partners' social media channels.

While we knew there was an untapped appetite for research amongst students attending state schools, the response to the project made it more evident. Of the students that took part in our At Home project, 73 per cent were from state schools and nearly half were new to IRIS.

Covid-19 also meant that we had to cancel our conference this year. Students from many schools submitted posters and videos to share their research findings. Students and teachers took the time to record and submit their talks to us for feedback, despite the pressure of imminent lockdown and school closure. We were delighted that so many schools were able to take part, albeit virtually.

“
While we knew there was an untapped appetite for research amongst students attending state schools, the response to the project made it more evident.
”



Director's
introduction
continued

Looking forward

This school year will be a very different one for us all. Covid-19 has placed the relevance and importance of our work in a wider context.

04

The Institute for
Research in Schools

IRIS

At a time when scientists are being relied upon more than ever to provide solutions to mitigate the threat from coronavirus and the impending climate crisis, safeguarding the pipeline of UK scientists has never been more critical. We believe that the skills students learn through carrying out their own research in schools, while also developing an understanding of the possibilities of STEM careers, are essential.

To make our projects more accessible, IRIS launched a new website in September 2020 with a host of project resources to make involvement in our projects even easier. We have adjusted each of our projects so they align more closely with the school year. This means all projects start in September and end in May, with similar phases and milestones throughout the year. Our year will culminate with one conference in May, and a celebratory event in June or July.

IRIS' 2020-21 conference will be virtual. We strongly believe that the face-to-face experience of presenting and sharing research findings with other students is extremely valuable and will undoubtedly be missed. To support our drive to increase the accessibility of our projects and to enable the highest-quality outcomes, we will be considering a hybrid conference model for the long term, where students can attend in person or virtually.

We will also make IRIS projects easier to do from home. Our evaluation of the Research in Schools - At Home project (read about it on page 26) showed that when enthusiastic students are given effective tools to work independently, they are successful. We'll continue to inspire students with exciting research, underpinned by straightforward and easily accessible resources. Our team will continue to support teachers and students either in person or online.

We have recently appointed two further Regional Schools Leads, bringing the total to four. This will increase our capacity to work with and support schools and students in reaching high-quality outcomes within their research.

As part of our commitment to bringing new and exciting STEM projects to UK school students, we're working with partners to develop a big data project. The aim is to build students' understanding of data science and develop their core skills within this growing field.

“There aren't enough highly qualified scientists to look at all the data we've taken. We need intelligent people who we can teach to understand what they're looking at to become our collaborators. So why not school students?”

Professor Gillian Wright MBE,
Scottish Astronomer and Principal
Investigator on MIRI, JWST



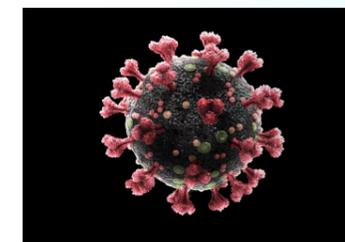
05

The Institute for
Research in Schools

IRIS



At a time when scientists are being relied upon more than ever to provide solutions to mitigate the threat from coronavirus and the impending climate crisis, safeguarding the pipeline of UK scientists has never been more critical.



Looking forward

To further support students carrying out original research while at school, we're continuing to develop partnerships with leading organisations, including the Centre for Doctoral Training in Cambridge. As of this year, any student with a strong research plan, whether associated with an IRIS school or not, will have access to a network of academics and institutions for specialist support within specific fields of study.

While we cannot be in every school in the country, IRIS will lead the way by illustrating the benefits of research to young students and sharing good practice. We will continue to support the development of research programmes in schools by encouraging collaboration and integration with our industry and university partners. We will also take a more active approach to becoming part of discussions to influence how the UK educates its future scientists, engineers and mathematicians.

IRIS is one of a growing chorus of voices demanding that the skills of research, collaboration and independent enquiry play an important role in students' education. The competencies of our young people, as well as their knowledge, will be key to helping us thrive as we approach the next few decades. I'm keen for IRIS to remain at the forefront of the development of these essential skills in our young people.

Our vision & aims

“
It is an ideal opportunity to strengthen self-confidence, build communication skills and foster collaboration with like-minded individuals.
”

IRIS student



Our vision & aims

Our vision is for UK students to ask questions that have never been asked before and then answer them, in collaboration with other experts in that field.

The Institute for Research in Schools aims to spark young people's passion for STEM subjects and instil an appreciation of research by:

- Providing opportunities to participate in cutting-edge STEM research while at school.
- Providing teachers and technicians with the support they need to contribute to, and mentor, science research with their students.
- Promoting and facilitating sustained research collaborations between schools and universities.

Trustees

IRIS is governed by our board of trustees, who are ultimately responsible for the direction of the charity and budgetary decisions.



Humphrey Battcock
Chair

Member of Cambridge University Campaign Board, Director of Cambridge Innovation Capital, Panel member of the Competition and Market Authority.



Professor Sir Leszek Borysiewicz

Current Chair of Cancer Research UK, formerly Vice Chancellor of the University of Cambridge.



Tim Edwards

Executive Chairman of Atopix Therapeutics Limited, previously Chair of Governors of Magdalen College School, past chairman of the UK BioIndustry Association, member of the Department of Health Ministerial Industry Strategy Group.



Professor Dame Julia Goodfellow

President of the Royal Society of Biology; formerly Vice Chancellor of the University of Kent.



Ann Mroz

Editor and Digital Publishing Editor of the Times Education Supplement (TES).



Professor Michael Reiss

Professor of Science Education at the UCL Institute of Education, University College London, Visiting Professor at the University of York and the Royal Veterinary College, Honorary Fellow of the British Science Association and of the College of Teachers, Docent at the University of Helsinki, Fellow of the Academy of Social Sciences and Member of the Nuffield Council on Bioethics.



Performance

Over 2019-2020, IRIS performed well against its key objectives, to:

1. Make the charity more financially and operationally sustainable
2. Engage more strongly with schools
3. Increase support for students carrying out original research

OUR AMBITION

To make the charity operationally sustainable by:

- Developing a consistent timeline across all school research projects.
- Engaging and supporting schools more effectively, focusing on quality of outcomes rather than quantity.
- Shift measurement of success to quality of registered school participation versus the quantity.

To make the charity more financially sustainable by:

- Identifying grant funding for 16% of our annual turnover.

Increasing support for students carrying out original research.

PROGRESS

All projects now aligned to the school year, running September to June.

- Launched a series of online support resources to help teachers get projects started and facilitate students working independently.
- Greater and more regular reporting on schools' progress.
- Greater focus on supporting individual schools over getting more schools on board.
- Achieved 96% engagement with registered schools; a number of schools have more than one research project.
- 217 schools listed as 'active' by end of academic year, twelve more than last year.

Our target was unmet. Potential funding streams were restricted due to Covid-19. We raised £14.5K out of £110K target and are actively pursuing other opportunities.

- Launched the IRIS Portal, enabling students to collaborate with leading STEM experts to inform and progress Original Research projects.
- Launched new resources for Original Projects in October 2020.
- Developed a dedicated area of the website for Original Research, packed with resources to support students launching their own projects.
- Established a partnership with the Centre for Doctoral Training in Cambridge to provide further support for students carrying out their own projects.

08

The Institute for
Research in Schools

IRIS



09

The Institute for
Research in Schools

IRIS



How IRIS is changing students' views of science and their futures.

Student impact



Our conference provides an ideal time to talk to students and drum up feedback for our annual evaluation.

Following our 2018-2019 conferences, more than 200 students responded to our survey. Around three quarters said they would recommend our projects to their peers. More than 75% of respondents stated the IRIS experience gave them a better understanding of science.

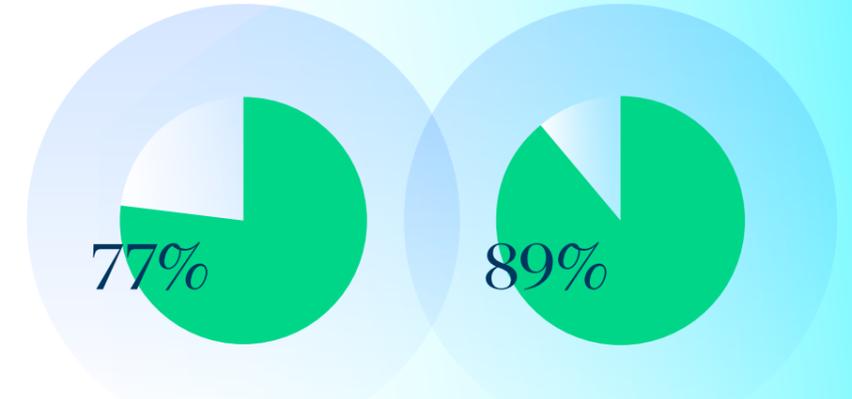
As a result of lockdown and the cancellation of the 2019-2020 conferences, we had a limited response to our survey. While just 54 students responded, their feedback was unanimously positive. Put simply, IRIS projects unleash students' passion for science and encourage them to study the subjects in university (89%) or pursue a science-based career.

“IRIS gave us a brief look into what a career in science could hold, which definitely encouraged me to consider what I could do with my science and maths subjects in the future.

”
IRIS student

Impact & evaluation

Our impact



Of students surveyed said that taking part in IRIS projects gave them a better understanding of science

After working on an IRIS project, 89% plan to study science at university

“To try things we have never done before and take a step beyond the curriculum and learn things I wouldn't have. I feel as if this project has allowed me to do that.

”
IRIS student

“I have found a new interest in this aspect of science and am keen to take it further especially in data analysis. It has also helped me be more meticulous in my work, which has translated itself into my school work and general life.

”
IRIS student



Awards

Student
impact
continued



Sahiba Khurana from Alec Reed Academy wins a CREST Silver Award

IRIS students win CREST Awards

IRIS is a huge supporter of the CREST awards, a nationally recognised scheme for student-led project work in science, technology, engineering and maths. The awards offer an opportunity for students to be recognised for high standards of research by industry experts.

We were very proud to hear that IRIS students from Alec Reed Academy, Sutton Grammar School and Abingdon School won CREST Awards for their research during the 2019-2020 academic year.

Two Year-10 students from Alec Reed Academy received CREST Silver Awards for their first-ever research projects. Their research involved tracking the Pine Island Glacier in Antarctica using satellite images as part of IRIS MELT project.

"Just before lockdown Alberto Munoz from Alec Reed Academy signed-up to IRIS. We were really impressed with his students' research on glacier movement and encouraged them to submit their posters for a CREST Award," says Mike Grocott, the Regional Schools Lead for the South of England for IRIS.

Students from Sutton Grammar won CREST Gold Awards for their highly commendable research



Sahiba Khurana, one of the students, enjoyed the experience. She said it gave her the opportunity to learn more about a subject she previously knew nothing about.

"We all found difficulties doing some of the tasks, but we kept trying and finding out," says Sahiba who was born in Kabul, Afghanistan, and wants to be a medical doctor.

She felt empowered with her new knowledge and is now more aware of the impacts of environmental change.

She said winning a CREST Award felt amazing and it really mattered to her as a science student with high ambitions.

"I think they deserved the award because of their enthusiasm in learning about glaciers and global warming, and because they worked hard in achieving a successful research project on a topic of actual relevance," said Alberto Munoz, the students' teacher.

Edward Fyles and Nadim Ahmed from Sutton Grammar School received CREST Gold Awards for their research 'An Investigation into the Toxicity of Ionic Liquids on Biological Structures'.

Sixth formers Ashwin Tennant, Scott Yap and Ivan Gabestro from Abingdon School were also awarded gold for their Cosmic Mining project. They assisted astrophysicists in identifying targets of interest for the James Webb Space Telescope, which will launch in 2021. They also submitted an article to the Young Scientists Journal which was published in September.

Student
impact
continued



The Globe of Science and Innovation CERN, Switzerland

Student Higgs Hunters present to ATLAS scientists at CERN

The Large Hadron Collider is an engineering and scientific triumph. It was here that the fundamental atomic particle predicted by Professor Peter Higgs, the Higgs boson, was discovered. The accelerator continues to serve humankind, providing an opportunity for thousands of people to gather and analyse data with the aim of unravelling the story of our Universe.

The University of Oxford extended this community further through the Higgs Hunters project, inviting citizen scientists to search for the undiscovered particles, coined Baby Higgs, using data acquired from the ATLAS experiment. This led to a massive effort from 37,000 scientists from 170 countries, resulting in more than 1 million classifications, flagging events that could potentially lead to the discovery of Baby Higgs. The collaborative process also revealed that citizen scientists could compete very well with computer algorithms in the analysis of collider data from CERN, performing better for many of the searches.

This extraordinary opportunity was extended to students around the country through the CERN@school project. It sparked excitement among budding young physicists to join a research effort which could potentially extend the frontier of physics. Led by Professor Alan Barr from the University of Oxford, students were given background information on what scientists knew about these undiscovered particles. He provided further explanations of how to classify and analyse data.

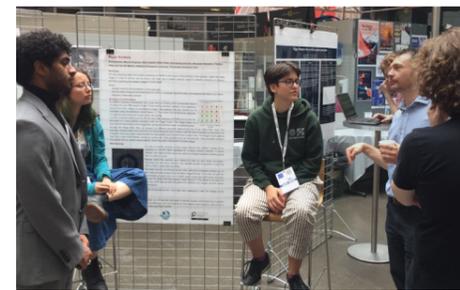
Adventurous young scientists performed further analysis of the citizen scientists' classifications. Each group generated their own investigation, choosing an aspect to research, producing results and analysing them. Students' analysis included clustering algorithms, complex machine learning algorithms, and databases for large data analysis.

Visit to CERN



Student impact
continued

"Visiting the ATLAS experiment inside the LHC allowed me to appreciate the true complexity of the research currently taking place."
Akshat Tripath, *Watford Grammar*



Students share findings with ATLAS scientists

Student Higgs Hunters present to ATLAS scientists at CERN

For a few of these students, the research culminated with a trip of a lifetime. In 2019, nine IRIS students travelled to CERN to present their Higgs Hunters research to world-leading scientists working on the ATLAS experiment.

The team at IRIS wanted to build on a student visit to Merton College, University of Oxford, the previous year where students presented their research findings to leading scientists. The CERN trip included a tour of the facility, incorporating a much coveted visit to the cavern housing the Large Hadron Collider, 175 metres underground.

Here's what the students had to say about the experience:

"The CERN visit was the highlight of the entire experience, visiting the ATLAS experiment inside the LHC allowed me

to appreciate the true complexity of the research currently taking place at CERN.

"I really enjoyed working on the Higgs Hunters project, as it allowed me to apply my understanding of maths, physics and computing onto a project with real world applications. I particularly enjoyed the freedom to explore the data, as it felt like a true experiment, while classroom experiments have set results. Participating in the project gave me confidence in applying what I learn in the classroom to real world problems.

"Visiting Oxford last year was an amazing experience, I loved meeting with other teams and actual researchers and seeing how each one of them explored the same dataset differently. After the poster session we took part in two physics experiments, one with an electron gun, and another with an interferometer. The experiments were a great way to showcase university physics to sixth-formers.

I really enjoyed working on the Higgs Hunters project, as it allowed me to apply my understanding of maths, physics and computing onto a project with real world applications



Student impact
continued

Student Higgs Hunters present to ATLAS scientists at CERN

"Thanks to participating in this project, the next time I am asked to give an example of when I worked as a team, I have an excellent answer; I used findings from CERN to conduct an investigation into finding an undiscovered particle, which culminated in a research conference at Oxford and a trip to see CERN itself! Going to CERN was an experience that I will never forget.

"It reminded me of why I wanted to study physics in the first place; physics provides irrefutable logical answers, backed by mathematics and experiment, to the Universe's unanswered questions such as why the Universe is the way it is today.

"Answering these questions is an essential part of being human; we have an innate desire to understand both ourselves and the world around us. What I was able to fully appreciate at CERN for the first time was how people from different races, upbringings and backgrounds had come together after two world wars and went to extreme lengths to build the world's largest physics experiment to try and answer these questions.

"This extended my feeling from last year's conference at Oxford, that physics itself is inherently open to all people who take an interest in it, so projects like IRIS, which widen the reach of physics to those who are unaware of what it has to offer them, are crucial to inspiring the next generation of physicists." - Elika Charlton, Camden School for Girls

"I would love to be able to talk in depth about the trip to not only Oxford but also to CERN, but I guess an experience can only be described so much in words but the actual experience will forever live on. When we were tasked with a project to analyse data at CERN, initially it would seem completely mind boggling and it's fair to say the whole process was a whirlwind in itself.

"But the chance to present our work at a world leading institute such as the University of Oxford to academics ranging from straight to particle physics was too great an opportunity to miss. Our work was primarily based on experiments that had taken place at ATLAS and, metaphorically speaking, for any journey to start there must be an end. Our trip to CERN to visit ATLAS befits a wonderful and truly remarkable journey - to visit the very place where our projects started.

"Our journey captured many moments from learning new skills; mathematical and computational; public speaking; presentation, however, what I can say, and perhaps what everyone can agree on, is the binding factor of fun that we have all experienced. Sure, the process was challenging but it was a challenge that captivated not only the mind but also the heart and that's just one of the many reasons why this unique experience will forever remain engraved in the memories of so many." - Shameer Mohamed-Naleer, Claremont High School Academy



Shameer Mohamed-Naleer
Claremont High School Academy



Case study – Lauren Charters *Student*



Lauren attended a state grammar school in Kent; neither of her parents went to university.

At 17, she was involved in a pioneering research project that unleashed her curiosity for the world of creative and systematic investigation. Lauren and her fellow school-age researchers were looking into the physical and mental benefits of biodiversity. The research involved testing the blood pressure of students in every year group before and after a walk outside during the school day.



Without being overdramatic, working with IRIS changed the course of my future by showing me how much I can make a difference.



"It was exciting to find that students across the age groups do benefit from taking just a 10-minute walk in a natural environment," recalls Lauren.

"But, more remarkably, we found that older students got the most from it. The experience helped to reduce their blood pressure and stress levels far more significantly than for younger students. We assumed that this [the stress] was related to the pressure of exams. Oddly enough, those students who walked inside for 10 minutes became more stressed.

"At the most fundamental level, the project taught me how human data collection works in practice – and sometimes how awkward it can be. Walking with 12-year-olds outside, trying to keep them calm and silent for 10 minutes, was often quite comic. I also

learned that if someone is nervous their blood pressure can skyrocket, and this can throw the data completely off.,z" said Lauren.

The students' work led to changes in the way their school used the outdoors for education, and also influenced other schools around the country. Lauren had the unique opportunity to present the findings of their research at the Authentic Biology Symposium held at the Wellcome Trust.

The IRIS team was very impressed with the research project. They asked Lauren to co-author a paper discussing the experiences of secondary school students who had presented their research findings to the scientific community at conferences.

"I found that students who had conducted research and presented their projects had developed a variety of new skills – not just academic skills, but others that will be useful in later life, such as confidence, resilience, teamwork and problem solving.

"The students also gained new connections and people to champion them. And, as an extra bonus, they felt like real scientists whose findings really were making a difference to the world around them," says Lauren.

Last year, Lauren was accepted to the Lady Margaret Hall Foundation Year, a University of Oxford scheme that aims to increase access to top universities for students from underrepresented backgrounds: those with low incomes or who are the first in their families to go into higher education. Lauren credits IRIS with giving her the confidence and experience she needed to be successful in her interview for her place at Oxford. Lauren would like to pursue a career in psychological research.



Three Year 12 students
Sir Robert Woodard Academy

Recognition

IRIS students recognised for cutting-edge research which could help clean-up the textile industry

Three students from the Sir Robert Woodard Academy have been offered work experience by Professor Tom Welton, President of the Royal Society of Chemistry and Professor of Sustainable Chemistry at Imperial College London, on the back of their involvement in IRIS' Ionic Liquids project. They will be working as research assistants in his world class facility labs at Imperial College London, collaborating with scientists to take their cutting-edge research a step further.

The Year 12 students have been creating ionic liquids that could potentially be used to absorb waste chemical dyes widely used in the textiles industry. Their work could provide a new water purification technique which could help reduce the polluting effects when this type of chemical waste is released into neighbouring rivers and lakes.

Jo Foster, director of IRIS, says it is occasions like these that really illustrate the strength of IRIS.

"IRIS was founded on the principle that if given the opportunity to cut their teeth on scientific research, talented students would unlock their passion for science and unleash a desire to do great things and know no boundaries.

"As IRIS continues into its fourth year, it's evident that our strong network within the scientific community is key to realising our founding principle. Individuals like Professor Tom Welton, who believe in and support our mission, enable us to give bright young scientists a leg-up in the world of research," continues Jo.

"We have been offered a rare opportunity to spend a week in the labs at the White City campus, Imperial College London. I am grateful that Professor Welton has provided this invaluable experience for us because of our involvement in the IRIS project. In the future I am hoping to synthesise and research medicines and specialise in biochemistry at a higher level. This work experience allows me an insight into a working environment in a lab.," says Lucy Rawlinson, Year 12 student at Sir Robert Woodard Academy.



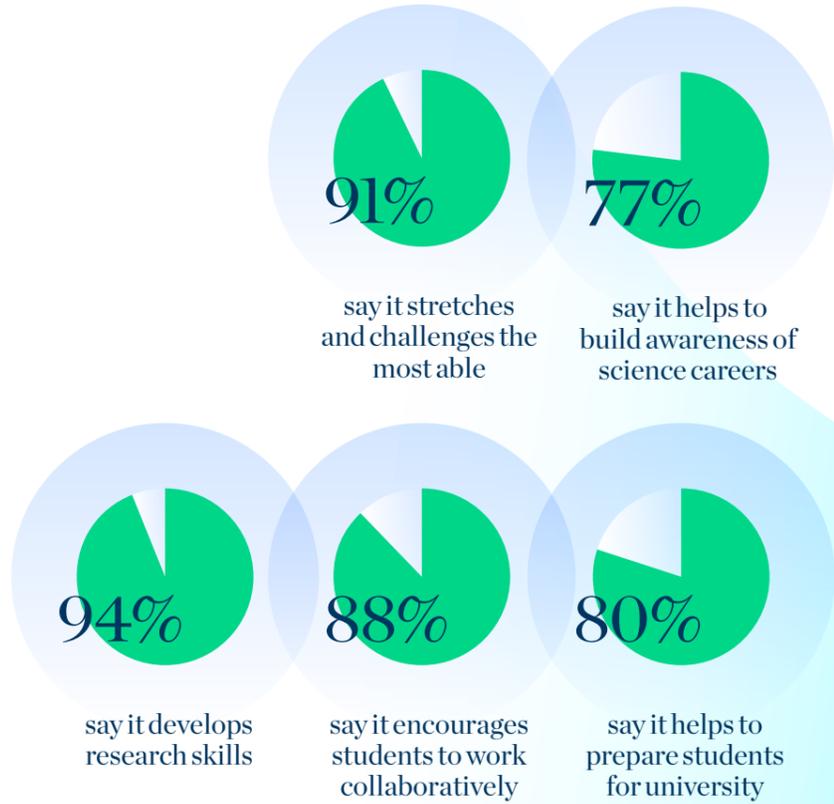


How IRIS supports teachers in instigating students' love for science.

Teachers' response

Teachers response
continued

What teachers say the benefits of working on IRIS project are to students:



Motivational

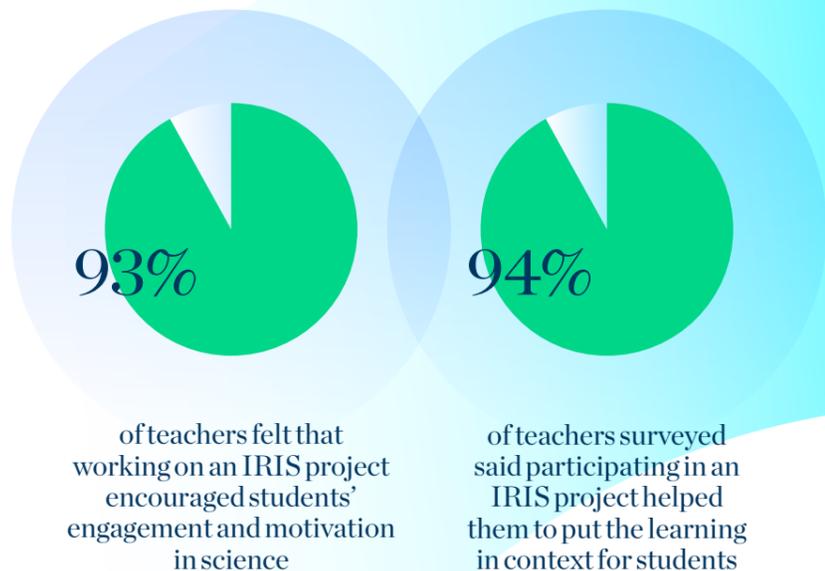




Engaging

Teachers response *continued*

Our impact



A great response from teachers

While our survey numbers were low due to lockdown and a cancelled conference, they supported the positive feedback from students. Over 90% of teachers felt that working on an IRIS project encouraged students' engagement and motivation in science, set science in context for students, and helped students to develop research skills. Over 90% reported that the project stretched and challenged the most able and 86% said it encouraged students to work collaboratively.

What's more, teachers said that working on an IRIS project helped prepare students for university (80%), helped improve awareness of science careers (77%), helped students develop a deeper understanding of some curriculum content (77%) and helped develop students' confidence in presenting work (69%). These responses closely echo the findings from last year's teacher survey, which reinforces that teachers believe IRIS projects have a positive impact on students' education in a wide range of ways.

What teachers said:

"We got involved in the MELT project for the first time last year and the students thoroughly enjoyed it. They learnt many scientific skills, including data collection and analysis. We are proud to have the school involved in a new project."

"[IRIS projects] teach the student very good quality research and team work skills and give a flavour of what actual scientific research is all about. IRIS also enables us access to real live data which we would otherwise find difficult to do and that access to data is what really makes these projects stand out from anything else out there on offer."

"This collaboration and sharing of ideas across a wide range of people and students will make a difference - much more so than just one individual school. This is what IRIS is very good at doing. You are also able to link in with universities as well."



Teachers response *continued*

Instilling a spirit of discovery in pupils –

James Allen
Head of Biology
Helston Community College



James Allen is the type of science teacher that every student needs. A teacher and scientist who opens your mind to what science is, alive and boundless, not trapped in history or systematic terms.

Involved with IRIS for the past four years, James strongly believes that students should experience science to fully appreciate the subject.

“The resources available through the IRIS website have been invaluable in helping the students who I've worked with develop their investigative and communication skills.”

“I find the complexity of the living world fascinating and I want to help students to understand this. We are still learning so much, not just about our own planet, and it is this spirit of discovery, as well as the ability to find the answers to unknown questions, that's what I want to instil in students,” says James.

James feels research is an ideal way for students to experience and understand science. In fact, he was first introduced to IRIS at the Royal Society's student conference where his students were presenting a research project.

An integral part of the IRIS experience is students' introduction to the culture of research. Sharing and collaborating is a significant part of the process, both during and following their period of intensive research. IRIS encourages all students to take part in its conference, an element of the process that James really appreciates.

“Students are often carrying out their research projects in isolation so for them to be able to talk with other

students doing the same thing was a brilliant experience for them. It was also really useful for me to be able to share my experience of trying to carry out research in school with other teachers who are doing the same and begin to develop a possible support network for future projects,” explains James.

James' students have been involved in many IRIS projects over the years, including Timpix, where students investigate radiation data collected by particle detectors on the International Space Station. One became so excited about the subject that he began an independent research project looking into the impact of radiation on mealworms, with a view to them being used in space as a food source.

“The way we are currently asked to teach science is not a true representation of what science actually is. The national curriculum, certainly beyond KS3, requires us to teach students a series of facts, with practical work being used largely to demonstrate a concept which students have been taught. This is why IRIS' work is so important. It gives students the opportunity to discover what true investigative science is like, and that we don't always know the outcome of a practical exercise before we start it,” comments James.

“I have been really delighted that after their involvement with IRIS projects, so many of my students have opted for degrees in STEM subjects at university” continues James. “One of our first ever projects was looking at whether artificial colouring caused hyperactivity in our class hamster. One of the girls who was involved in that project has just finished her degree and had begun a PhD in neuroscience. I am very proud and privileged that her passion for that subject started here in my lab.”

The conference allows students to share their research more widely



It is an opportunity to strengthen self-confidence

IRIS 2019-2020 Conference

We encourage all IRIS students to present their research at our conferences. It is an ideal opportunity to strengthen self-confidence, build communication skills and foster collaboration with like-minded individuals.

In the spring of 2019, we held five conferences around the country which were attended by more than 250 students. Unfortunately, we had to cancel this year's conferences due to Covid-19. We offered students the opportunity to submit posters and videos of themselves presenting their research findings. We were delighted that so many schools were able to take part, albeit virtually.

Thank you to all the teachers and students that took part. Particular congratulations to St. Augustine's Priory, The Ladies' College Guernsey and William Perkin and Ada Lovelace CofE High Schools, who received Highly Commended for their presentations, and Camborne Science and International Academy, Godolphin and Latymer, Stirling High School

and Robert Woodard Academy, who achieved Highly Commended for their posters. The top posters, from *'Investigating distribution and transfer of ocean plastics'* to *the Analysis of infrared spectra*, are all featured on our website.

Ladies' College, Guernsey and St Augustine's Priory worked with us to develop short videos to showcase their Highly Commended research. Recorded by students, their families and teachers at their homes during lockdown, the footage captures their unique passion for the research projects. The videos can be viewed on the IRIS website.

“
It is an ideal opportunity to strengthen self-confidence, build communication skills and foster collaboration with like-minded individuals.
”

IRIS student

Conferences

IRIS 2019-2020
Conference
continued



Upcoming conference

Held in the spring, our conference is an opportunity for young researchers to exhibit artefacts and present their findings. Select students are invited to share their artefacts with a VIP audience from the UK's scientific community at our prestigious Summer Showcase.

Due to Covid-19, we are planning a virtual conference for 2021. We believe the online format will allow more students to get involved and share their research. We will be working behind the scenes to ensure we deliver an impactful event that encourages collaboration and learning and champions student research.

“
We believe the online format will allow more students to get involved and share their research.
”



Home research



IRIS project entices a new wave of students to explore the stars

An impressive 187 students from 60 schools spent time over lockdown and the summer term exploring the stars from their laptops as part of IRIS' Research in Schools – At Home project.

Marcus Bernard, IRIS Regional Schools Engagement Lead, developed the At Home project just days after the Government announced the temporary closures of UK schools.

For these budding scientists, the project offered an opportunity to expand their science capital, learn new skills and delve deeper into key physics themes, such as the Electromagnetic Spectrum and Life Cycle of a Star.

It was a unique chance to identify stellar objects from data that came from the Spitzer Space Telescope. Students learned how scientists select potential targets for the James Webb Space Telescope. The telescope, described by NASA as the world's premier science observatory for the next decade, is expected to launch in October 2021.

"The impact was better than we expected; not only did the project excite and challenge students but it introduced IRIS to a wider range of students than ever before," says Marcus.

Around 73 per cent of the students who participated were from state schools and almost half were new to IRIS.

"We knew UK secondary students were facing weeks, if not months, of home-based study during an all-important-part of their education. Our aim was to develop a research project that sparked students' curiosity and propelled them to get stuck into real research, all from the comfort of their home," adds Marcus.

Marcus worked with our partners from the Science and Technology Facilities Council to adapt elements of the James Webb Telescope Cosmic Mining project. Within days the Research in Schools - At Home project was born. IRIS promoted it through its network of secondary schools and worked with its partners to publicise it on social media.

Home research *continued*

IRIS project entices a new wave of students to explore the stars

With their newly-honed skills, IRIS hopes that the students continue their research journey by advancing onto the full Cosmic Mining project. The full research project allows them to search for unique and unusual stellar objects which could assist astronomers in their preparation for the JWST.

"It goes to show what students can achieve when their imagination is captured. It is an important message for teachers reluctant to take on an IRIS project. Enquiry-based learning opportunities like this allow students to really engage in a subject on a deeper level, which is so valuable to their education. More importantly the experience does not need to be time intensive for the teacher. With a little guidance, students take the lead. That's the beauty of real research," says Marcus.

What student participants said:

- It was fun and they enjoyed it.
- They could apply their new knowledge from the project to real life science.
- The project was easy to access and the guidance easy to follow.
- They joined because it sounded interesting and they wanted to learn more about the topics involved.
- The project increased their knowledge of the life cycle of stars, telescopes and the electromagnetic spectrum.





Star exploration

Home
research
continued



Amy Walter
Plymouth High School for Girls

Cosmic mining at home *IRIS helps Plymouth student prepare for university during 'unsettling time'*

Amy Walter, an 18-year-old student at Plymouth High School for Girls, was one of the 187 students to complete the first ever IRIS Research in Schools – At Home project. As she begins her study of design engineering at Imperial College London this autumn, Amy appreciates the need for a good foundation in physics to excel at university.

During lockdown, Amy was completing a physics A level - as well as chemistry, maths and further maths. She saw the project as an opportunity to keep her hand in.

"It was interesting and exciting to read around the content I covered at A-level and apply my knowledge to research that is essential for us to further our understanding of the Universe. The project advanced my independent research skills and has given me an overview of what research projects involve, which I'm sure will be required when I go to university.

"It is unsettling not knowing whether term will start on time or if it will involve online teaching. This experience has been useful since it promotes online, self-supported learning. I certainly feel more ready and confident, no matter if I start my degree in person or online."

“
I am passionate about astronomy and want to get involved where I can, especially since I have the time in lockdown which I want to use wisely to prepare for university.
”

Amy Walter



We partner with leading research institutions to introduce a wide range of research projects which spark students' excitement for STEM subjects.

Our projects





Our projects

Our projects



Original Research

Once students master the fundamentals of research, we encourage them to advance onto original research. We are supporting an increasing number of students with high-level research projects, through our links with academics and industry. Some of these students will go on to present their work at our conferences or submit scientific papers to peer-reviewed academic journals.

“We have been involved with IRIS from the outset, closely following its development, and are hugely impressed by its success in bringing live research into schools. The inspiration this provides to embryonic scientists is clear to be seen both in their enthusiasm and in the outstanding quality of their work. IRIS’s impact is far-reaching and consistently exceeds expectations.”
Nigel Williams, CEng,
Secretary of The Royal Commission for the Exhibition of 1851



Amazing Atmospheres

Armed with mobile carbon monoxide detectors and sensors set up throughout their schools, students from around the country measured the levels of atmospheric gases in their community.

Students set their own research objectives to uncover answers to their questions regarding air quality. For some, this involved comparing the data they collected with information from other schools. Other students measured their teachers' and peers' lung and heart function to see if there were any correlations between the number of particulates identified in the air and people's health. While their research and conclusions varied, students learned all about data, how to collect it, how to analyse it and why these elements are important when influencing decisions on public health.



Our projects continued



Carbon Researchers

Now in its third year, Carbon Researchers encourages students to look at their school's contribution to global warming by calculating the carbon impact of its operations and activity. Furthermore, pupils make a plan for decreasing the school's carbon impact. They are encouraged to present their findings to their school and wider community and to develop a legacy for carbon control for the future.

Assessing the school's carbon contribution, requires collaboration with peers, teachers and various school departments to collect data. This part of the process builds students' confidence and communication skills.

“When we showed the staff in the science department how many kilograms of CO2 they were producing, they were quite surprised by it.”
Student,
Stirling High School.

“It was really good to be able to work with different people from different stages in the school. I also loved calculating our carbon footprint and being given the trust to work with our school bursar to handle the bills of the school.”
Student,
St Augustine's Priory

Partnes



CERN@school

Now in its tenth year, CERN@school has been inspiring young scientists and engineers by offering access to CERN technology. Around 100 students have carried out their own research projects using detectors provided by IRIS. This work is celebrated each year at a Research Symposium at CERN in Geneva. Some schools have built on previous years' research, firmly embedding CERN@school in their programme of activities.

Partner



Our projects



Cosmic Mining

Over the last two years, students from nearly 50 UK schools have analysed data to uncover stars forming and fading in our galaxy and beyond. Through this astrophysics project, students contribute to studies which aim to identify how cosmic materials were created over the history of the Universe. It is hoped that students' efforts, ultimately, will help astronomers identify potential targets for the James Webb Space Telescope, which will launch in October 2021.

In response to lockdown, IRIS adapted elements of this research project to enable a new wave of students to gain the skills needed to complete Cosmic Mining (read more about it on page 26). We hope a large proportion of these students will progress onto the full Cosmic Mining project.

“Participating in a real research project, which has an effect on the discovery of new stars and exo-planets has been captivating, especially because it is different and more in depth than what is in the curriculum at school.”

Student,
Camden School for Girls.

“We have been pleased to see how effective the Cosmic Mining project has been in providing opportunities for students to participate in cutting-edge research and prompting them to consider further study and careers in STEM.”

Dr Olivia Johnson,
Campaign Lead for James Webb Space Telescope Public Engagement at the Science and Technology Facilities Council

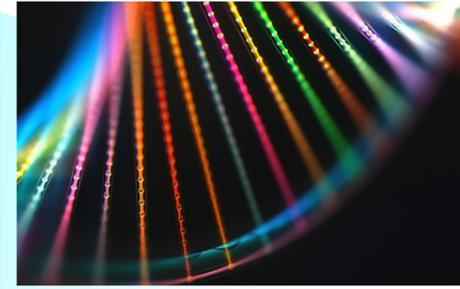
Partners



Earth Observation

Since the inception of Earth Observation, 120 UK students have monitored changes in our natural world. As they learned to recognise and analyse data, young researchers set off to track geological processes and investigate the frequency of floods and fires. Some of their work has contributed to scientists' understanding of the planet's landscape. This year, two students presented their findings to world leading scientists at a European Space Agencies conference at Leicester University.

Partners



Genome Decoders

IRIS students from more than 50 UK schools have already contributed more than 8,500 annotations of the human whipworm genome, which will benefit research into treatment for the neglected tropical disease Trichuriasis. The students' contribution takes scientists more than 80% towards completing the annotation of the protein-coding gene set. The aim is for IRIS students to complete the necessary annotations by the end of 2021.

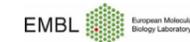
“It has been fantastic to see so many schools across the UK come together to take part in Genome Decoders. Seeing students from as young as 13 taking such an enthusiastic and active role in the annotation of the whipworm genome has been truly inspiring.”

Francesca Gale,
Wellcome Genome Campus

“This is the first time that anyone has tried to curate a genome in this way, and we've been well supported by IRIS throughout the experiment. The highlight for us has been helping students to interact with real data, and give them a sense of what real research is like.”

Dr Faye Rodgers,
Senior Bioinformatician, Wellcome Sanger Institute

Partners



HiSPARC

A collaboration with the University of Birmingham, HiSPARC enables students to find out more about cosmic rays. Students have access to cosmic ray detectors and learn how to collect and decipher cosmic data.

IRIS has supported a number of schools' involvement in HiSPARC. It has inspired a wide range of school research into cosmic rays. Students have set out to find out if building materials used in their schools attenuate cosmic rays. Some curious minds have devised projects to figure out if the Sun is, in fact, the main producer of these particles on Earth. Others researched the impact of temperature and pressure on the detection of rays.

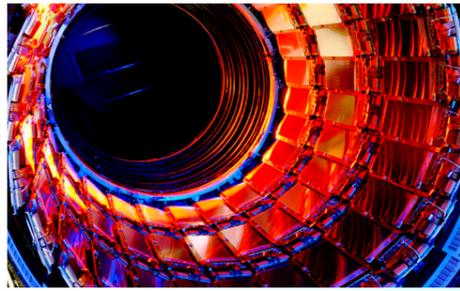
Partners





Our projects

Our projects
continued



Higgs Hunters

UK students have had the opportunity to contribute to the search for undiscovered particles, coined Baby Higgs, using data acquired from the ATLAS experiment. For a few of these students, their research culminated with a trip of a lifetime. Nine IRIS students travelled to CERN in Geneva to present their Higgs Hunter research to world-leading scientists working on the ATLAS experiment. Read more about their experience on page 16.

Higgs Hunters has been a huge success, appealing to a wide range of schools. It has not only impacted students academically but has enabled them to develop wider research and soft skills. It has also contributed to many students' growing interest in science.

"I really enjoyed working on the Higgs Hunters project, as it allowed me to apply my understanding of maths, physics and computing onto a project with real world applications. I particularly enjoyed the freedom to explore the data, as it felt like a true experiment."

Student,
who worked on Higgs Hunters

Partners



Ionic Liquids

Once students learn to synthesise their ionic liquids, they are able to explore the unusual properties of this unconventional compound. In this academic year, around 100 students have taken on this challenge which allowed them to stretch their understanding of chemistry. Students have characterised their ionic liquids at university laboratories using NMR, produced carbon nanoparticles and applied ionic liquids to real world problems in their investigations.

"With this, it is our project, we do what we want. That's not really an experience you get with most things."

Student,
Sutton Grammar School

"With the help of IRIS, Ionic Liquids has expanded far beyond our expectations, reaching schools nationwide. The result has been a huge increase in the reach and impact of our outreach, and opportunities for school pupils to engage in real scientific research."

Robert Palgrave,
Professor of Inorganic and Materials Chemistry at UCL

Partner



Our projects
continued



Treezilla

Over the past two years, students have taken part in this ambitious project to map Britain's trees. Through Treezilla, students contribute to the Open University's efforts to chart the UK's tree canopy. Students select trees within their local area and gather data about them. This provides a practical way for students to gain a greater understanding of the immediate impact of climate change on their local world and the benefit of planting trees to support carbon reduction.

The information gathered helps scientists record vital data about tree disease and the environmental benefits that trees provide. The map will be used for education, outreach and research purposes, and for the UK's biological monitoring.



Vertigo

Young mathematicians across the country developed research projects using Vertigo, a lightweight, mobile tool which records location and movement using an internal accelerometer, gyroscope and GPS. Studying movement in an unconventional way allowed students to experience mathematics in action.

Students explored a multitude of activities, from exercise and sport to riding a rollercoaster. To collect data, they simply attached Vertigo to the person or object they were measuring. Once the activity was complete, they downloaded the data onto their PC.

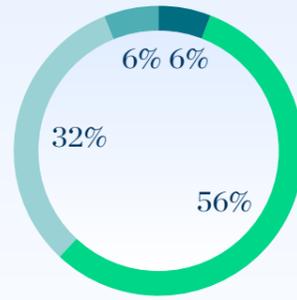
Students used mind-bending maths to uncover the relationship between power and movement. A student from Chipping Camden School deciphered the amount of power a cyclist needs to maintain their speed. Students from Liberton School researched the physics of an 'ollie', the skateboarding trick where the rider and board leap into the air without the aid of their hands. Young researchers from Sutton Grammar School took their investigation to the ocean to find an inexpensive, effective method to measure heights of waves using free-floating buoys.

Partners



Accounts	2019/20	2018/19
Income Grants, Donations & Interest	£851,281	£560,321
Expenditure on Charitable Activities	£605,972	£589,333
Net Funds at 31st March	£402,895	£157,585

How we spend our funds



- Operational support
- School support
- Office & overheads
- Support & governance

34 Finances

IRIS continues to operate on a lean model, optimising expenditure to direct as much as possible to front line delivery with schools.

Year on year, overall expenditure has only increased marginally despite the investment in recruiting new members to the team in early 2020 – a communications manager, a second school engagement leader to cover the midlands and the North, and a graphic designer to help with the rebrand and construction of a new website.

The cash-in-hand at the financial year end reflects an additional boost of funds, on top of the reserves held, to help address any challenges faced as a result of COVID-19, especially as a result of any reduction in grant funding available during the outbreak. Our robust financial management and focused delivery model will enable IRIS to see through the current storm and continue to deliver projects in schools.

The percentage of the budget spent on office and overheads remained broadly level with the previous year as the strategy to invest in strengthening our infrastructure continues. Prior to COVID-19, IRIS was already operating with a remote team working from home and using the latest technology to minimise the headcount required to run the charity and facilitate communication. All of this meant that IRIS had the tools to meet the challenges of the virus outbreak and could channel its energies into amending our projects to reflect home-based education. Much of the IT is in place, including an upgraded website launched in September. This will mean that, aside from annual licence costs, IRIS can add additional schools and projects with the minimum of overhead costs, enabling more funds to be channelled into working with schools.



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The Institute for Research in Schools collaborates with leading research institutions and universities to bring opportunities to UK schools.



Our partners





Thank you

Our partners

Carbon
Footprint

CERN

Cheltenham
Science Festival

Centre for Polar
Observation and Modelling

European Bioinformatics
Institute

Institute of Experimental
and Applied Physics, Czech
Technical University

Sanger
Institute

Science Technology
and Facilities Council

STEM
Learning

UCL

University of Cambridge

University of Oxford

We the Curious

Wellcome Genome
Campus

Our funders

Thank you to following
organisations for supporting us.

Garfield Weston
Foundation

Royal Commission for
the Exhibition of 1851

Science Technology
and Facilities Council

The ERA
Foundation

UK Space Agency

Wellcome Trust

In-kind contributors

The following organisations
provide us with offices.

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The Institute for
Research in Schools

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