

## Royal Society student conference 2022 project abstracts

The student conference, supported by The Goldsmiths' Company Charity, celebrates the work that school students have completed through the Society's [Partnership Grants](#) scheme and [Tomorrow's climate scientists](#), both supporting investigative project work in UK schools in collaboration with a STEM professional.

In 2022 the conference moved to an online format to allow schools from the 2019 and 2020 grant rounds to celebrate their work. The student conference on the 8 – 9 February 2022 will highlight projects from primary and secondary schools across the UK with students giving short presentations followed by a Q+A with invited scientists.

If you would like more information about the student conference or the Partnership Grants scheme, please contact the Schools Engagement team via [education@royalsociety.org](mailto:education@royalsociety.org).

### Student conference sessions 2022

#### Tuesday 8 February

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#### Wednesday 9 February

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The abstracts for all the projects being presented can be found in this document. You can also view the posters for all the secondary level projects via the Royal Society website: <https://royalsociety.org/grants-schemes-awards/grants/partnership-grants/case-studies/2022-student-conference/>

Tuesday 8 February 9am – 9:45am

## **Session 1: Primary showcase**

### ***Can Martian soil sustain life?***

Broughton Primary School

Year 5 and 6 students from the school have been investigating if Martian soil can sustain life by comparing the growth of a range of plants in Martian soil (replicated from NASA) and soil from Earth. The students have observed the size and speed of growth of the various crops and then looked at how they can develop robots to best sow, tend, water and harvest crops in replicated Martian conditions. This has included considering the different terrains on Mars and how to protect the plants from UV rays and the extreme temperature variations observed on the planet. This project has been undertaken in collaboration with a STEM Partner from Engineering UTC Northern Lincolnshire and the Open University.

### ***How much can we reduce our school's use of fossil fuels by generating renewable energy on site?***

Modbury Primary School

This project has been investigating whether students could provide the energy needed for their school's day-to-day running from renewable energy, allowing them to reduce their carbon footprint. They have measured energy use from electricity, gas and oil, and solar radiation and wind energy on site over the course of a year. By comparing the energy use and potential energy gain, the students have been able to come to some conclusions and help answer their original question, hopefully allowing the school to become greener in the future. This project has been undertaken in collaboration with a STEM partner from the University of Exeter.

### ***How can we discourage invasive species from colonising our pond?***

St Joseph's School

The children at St Joseph's School have been investigating their local water courses, researching the history of the sites and the difference between invasive, non-native and native species. They have then used this new knowledge to compare the biodiversity and health of two ponds. They have also investigated the impact of management options on pond health such as varying light levels, pollution levels, biosecurity actions and rapid response management activities. This project has been undertaken in collaboration with a local Biosecurity and Invasives Manager from South West Water.

Tuesday 8 February 10am – 10:45am

**Session 2: Biology, chemistry, environmental science and mathematics**

***What are the effects of current climate change mitigation policies on the local environment?***

Lady Eleanor Holles

Our team has been building a weather station from scratch for our school. Currently, our station includes a wind speed and a wind direction monitor, a pyranometer (which measures sunlight, temperature, and humidity), a rain gauge and a solar panel (which will power the weather station). These components will be connected to a circuit board which will be able to record the data from our local environment and share it onto a global network which will allow others to see our data as well. We have been working on this for almost a year and are close to fixing it onto a pole in the school grounds. The aim of our project is to observe whether climate change mitigation policies implemented by the government are effective in our area, and we predict that our data could show the impact of these policies.

***How can solar power help those in Zambia light their homes?***

St Patrick's College

Our Principal launched the project in Autumn 2020, speaking about her visit to the parish of St Teresa's in Lusaka, Zambia. Pupils were curious to see how they would take part in this work-based learning project; researching, designing, and developing a solar light that could help those less fortunate to improve their chances in education by having light at home to complete their homework. Pupils researched electricity and completed an in-depth study into current solar lanterns and the components used within them. Pupils then began to complete their design work in Technology and Design. As lockdown hit, this had to move to using a remote software, TinkerCAD. Pupils remained motivated and engaged throughout, which allowed them to be ready to begin manufacturing on their return in March. When the pupils began manufacturing, they developed a range of skills from making their circuits, cutting wood, making casing, and then varnishing their final products.

Wednesday 9 February 9am – 9:45am

### **Session 3: Primary showcase**

#### ***Why are earthworms so important to our world?***

St Gregory's RC Primary School

The children have taken part in a range of scientific enquiry activities with a real life purpose to help them understand the importance of small creatures, in this case worms, in our ecosystem. The students have explored the husbandry of composting worms and soil dwelling worms as well as investigations into their growth and reproduction, and how the types of leaves they digest can affect this. The students will have come to better understand what Charles Darwin meant by his statement: "*It may be doubted whether there are many other animals which have played so important a part in the history of the world, as have these lowly organised creatures*". This project has been undertaken in collaboration with a STEM partner from the University of Central Lancashire.

#### ***What would be the impacts of growing green walls on learning and wellbeing in our school?***

Earlsdon Primary School

This science project has seen Year 4 children design, install and grow plants on living walls in both indoor and outdoor environments, such as the classroom and in their play area. The students developed their knowledge of plant identification and assessed both flowering and crop plants for inclusions in their community areas. The students undertook investigations looking at the growth of plants in different general settings within the school, comparing growth in different light conditions and analysing the impacts of the plants on the physical wellbeing of students and staff, looking at changes on their learning. This project has been undertaken in collaboration with a STEM partner from De Montfort University

#### ***Can Mr Woodward win the race on a bottle boat?***

Heath Mount School

All year groups, from Nursery to Year 8, have been involved in the investigation into how much plastic each class produced in waste in a week. Using the waste bottles collected in the initial investigation, the students built and tested boat prototypes through floating and sinking experiments. The most successful prototype was then developed to make a giant kayak that could take the mass of a grown man. The full size kayak, made from the waste bottles that the school has collected, used no new plastics apart from new adhesives that had to be used to hold the kayak together and make it safe. The kayak was tested with a volunteer teacher, inspiring the students to think where they could go next with the idea of reusing the bottles / plastic further - a greenhouse to grow food? This project has been undertaken in collaboration with a STEM partner from AirBus.

Wednesday 9 February 10am – 10:45am

## **Session 4: Physics, computing, engineering and mathematics**

### ***How can data logged from flight be analysed to improve performance?***

Bourne Community College

Our project involves the use of Micro:bits in dowel-and-paper planes to plot an accurate flightpath during experimental flights. A Micro:bit data logger recording X, Y and Z axes is placed inside the craft, then the plane is thrown, and the data logger records the acceleration in each direction while the flight time is recorded manually. The figures are then placed through equations: velocity is equal to acceleration divided by time ( $V=A/T$ ) followed by displacement which is equal to velocity divided by time ( $S=V/T$ ) before finally being substituted into trigonometry to work out the true alignment of the plane.

This can be placed into an algorithm that allows us to better see from accurate flight data when the human eye may fail, providing vital information on the flightpath of the plane using a fair, accurate and reliable approach. The data gathered while repeating the experiment under different conditions will allow us to improve on our models.

### ***Do computers see what we see? Exploring artificial intelligence and its ability to aid accessibility***

Northfleet Technology College

This project explored Artificial Intelligence (AI) and the potential for it to aid accessibility and inclusivity.

We believe that the availability of machine learning algorithms can:

- provide advance warning through recognition of colour coded environments and signs
- report feelings on analysis of facial expressions
- recognise known, and raise awareness of unknown, individuals
- translate freehand text

The methodology used centred on the use of the NVIDIA Jetson Nano machine learning hardware. Leveraging Python as the major programming environment, the system was trained with existing and student generated data sets including images and text. As the systems were trained, the confidence levels of recognition indicated how well the system could alert the user in a range of increasingly diverse situations. Initial work was undertaken using the IBM cloud servers to develop awareness of training data processes, person to machine interaction and revision of training approaches. The project migrated to the use of Google's Teachable Machine. This environment provided the computing resources to rapidly train with several thousand pieces of data. This provided increased reliability of outputs.

Wednesday 9 February 11am – 11:45am

## **Session 5: Biology, chemistry, environmental science and mathematics**

### ***What impact do disposable contact lenses have on the environment?***

Bolton Schools Boys' Division

Contact lenses are a popular alternative to glasses for vision correction and fashion. Whether they are changed daily, weekly, or monthly they ultimately end up being thrown away. The hydrogel polymer in the contact lens is very durable which makes them resistant to decomposition. In our initial tests we found that contact lenses were virtually indestructible when boiled, dried, or treated with enzymes. The aim of our project is to design a gel system that will weaken the polymer in contact lenses so they will decompose more quickly in the environment. We have found so far that alcohol hand gels and Swarfega have a permanent effect on the contact lenses, and we aim to use Raman spectroscopy to determine exactly what is happening in the polymer. Ultimately, we want to produce a system to pre-treat disposable contact lenses before disposal.

### ***Can a school-based digital weather station provide accurate and useful data?***

Corbridge Middle School

Our school-based weather station has been collecting accurate and useful data for two years. We are now focusing on heavy rainfall events as these have caused localised flooding and problems with soil erosion from farmland. Alongside our partners at Newcastle University we have considered what 'climate change' means and whether sudden downpours are increasing in number and intensity; it is almost impossible to attribute these events to climate change, so we need additional evidence. Small weather stations, such as ours, result in more data on such events. We have learned about sustainable urban drainage systems (SUDS) and are building a model SUDS house to test the efficacy of different designs such as water-butts, ponds, and rain gardens to slow down surface runoff and mitigate flooding. The project has also prompted us to raise awareness of climate change by running a whole-school mock COP26 and to take climate action.

### ***How do trees affect our climate and air quality?***

Ribblesdale High School

Our project looked at the effect of trees on the climate and air quality in our local area. Based in Clitheroe we are surrounded by woodland such as the Trough of Bowland however we also have one of the busiest A-roads in Britain. Our aim was to investigate and measure, using sensor technology, the pollution in different areas. Our main objective was to explore the data received from the sensor technology to discover correlations and relationships between the data and interpret what this means. Another important aim of ours was to share our data with the local community through our local Primary Schools in a meaningful way. The sensor technology collected data every 3 minutes over 48 hours. We had to look through the data to detect variations in the different pollutions and then correlate this with the day, time, location, weather, and any other factors we recorded.