# Working smarter with schools:

**A reflection on how universities can work more effectively with secondary schools**

Scott Tompsett – Department of Life Sciences

1872 PRIFYSGOL ABERYSTWYTH UNIVERSITY

# Trio Sci Cymru (TSC)

- £6.2m ESF collaborative schools outreach programme
- Welsh Government lead beneficiary
- Four joint beneficiaries– Aberystwyth, Bangor, Cardiff and Swansea universities
- Aimed at increasing uptake of STEM subjects in 11-19 age group – Triple Award GCSE science
- 49 schools engaged with 6096 student interventions
- Targeted intervention following a single cohort of students through Key Stage 3 (Years 7-9)
- 2018 - 2021 – Spanning the COVID-19 pandemic

# AU Outreach – The bigger picture

**SusNet – 2013-2017**

- Part of the School-University Partnership Initiative (National Co-ordinating Centre for Public Engagement)

**Centre for Widening Participation and Inclusion (CWPSI)**

- Summer University
- Widening participation activities with local school students

**Global Marketing & Student Recruitment**

- Science Week
- Access All Aber
- Reaching Wider

# Trio Sci Cymru Team Aberystwyth

**Academic leads**:

- Prof. Jo Hamilton - IBERS (now DLS)
- Prof. Andy Evans - Physics

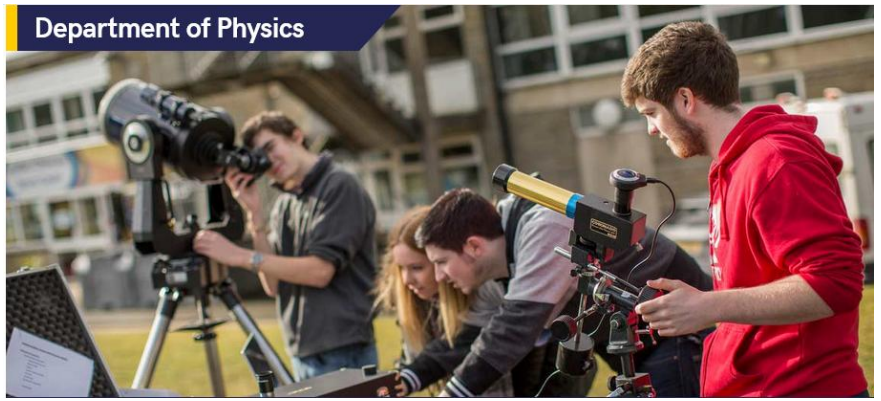
- Dr. Rachel Cross (Physics)
- Dr. Joanne Wallace (IBERS)

**Project manager:** Meinir Davies

**Delivery Team:**

- Rachel Keeble (IBERS)
- Scott Tompsett (IBERS)
- Carys Huntly (Physics)
- Lauren Colbeck-Kirby (Physics)
- Martin Nelmes (Physics)

- Robin Lovatt
- Jackie Hedley



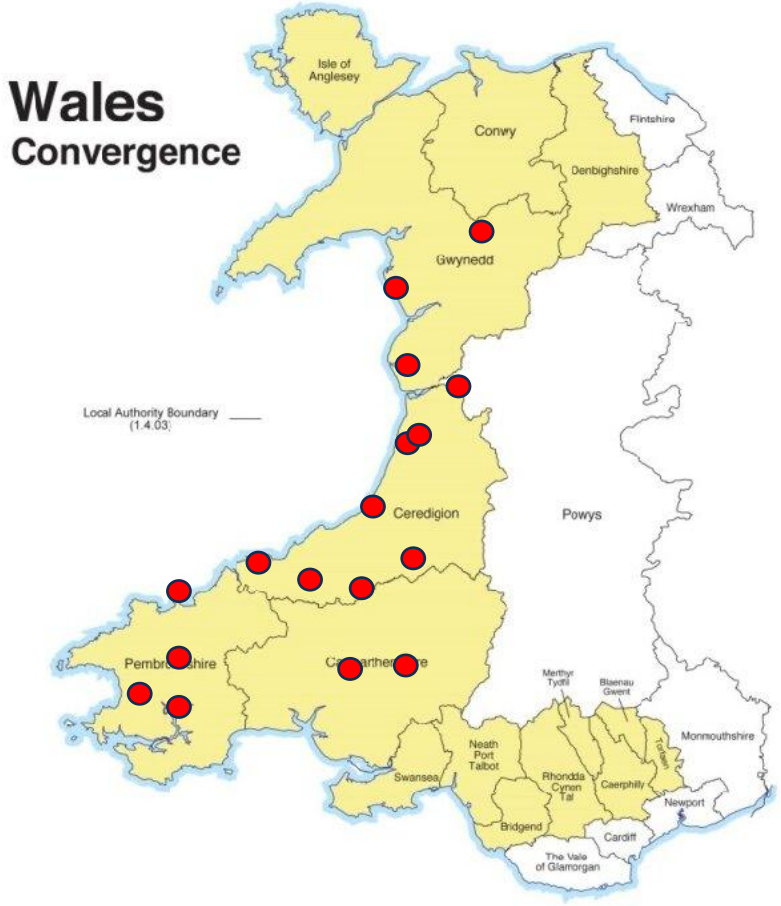

# Geographical Coverage

**16 Schools covering five counties in West and North Wales:**

- Ceredigion
- Powys
- Gwynedd
- Pembrokeshire
- Carmarthenshire

**Key Characteristics**

- Rural
- Coastal communities
- Some with high levels of social deprivation
- Welsh language schools



# Delivery

**Pre-pandemic**

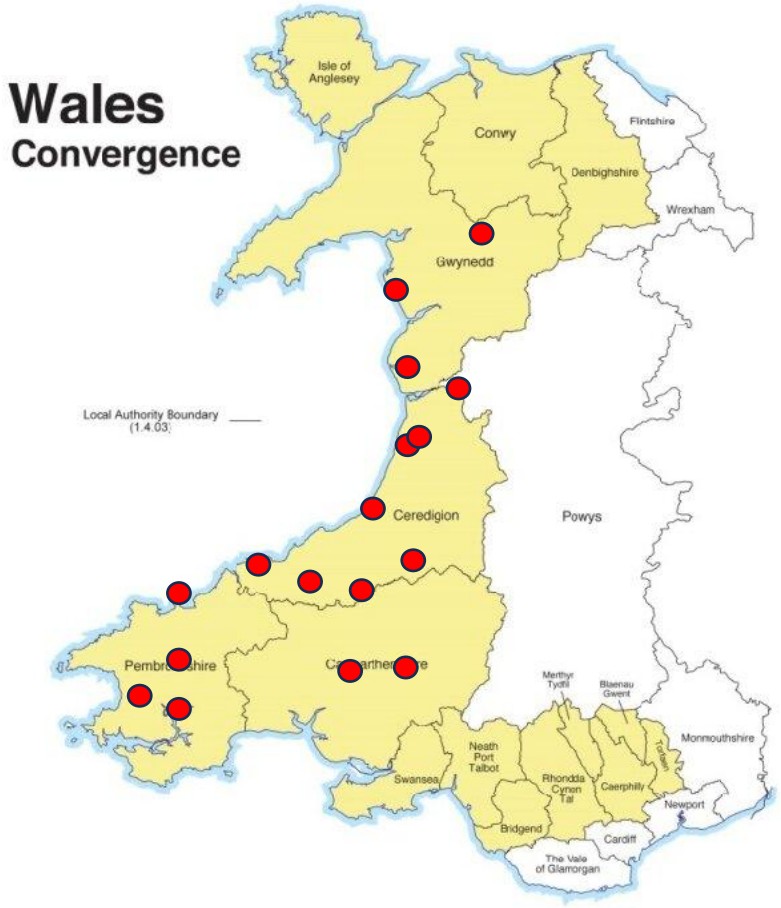
- All day STEM events
- Individual workshops in class time
- Lunchtime STEM clubs

**During the pandemic -**

- Online activities – Virtual learning environment
- Loan boxes of equipment e.g. forensics, blood typing

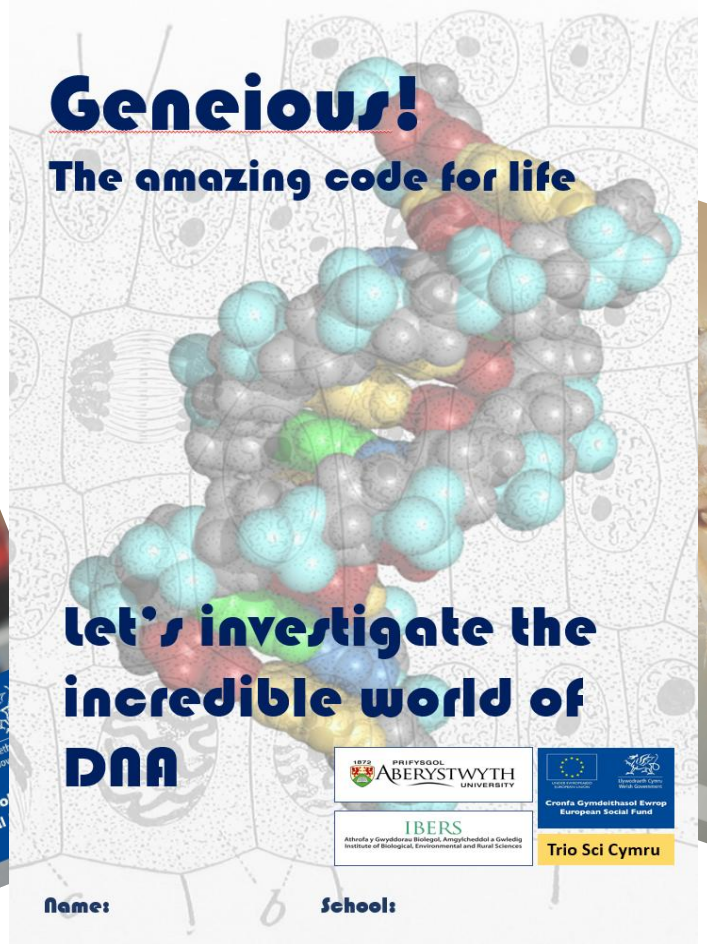
**Overall Engagement:**

- 1299 students engaged in the project
- 6929 hours of face-to-face contact

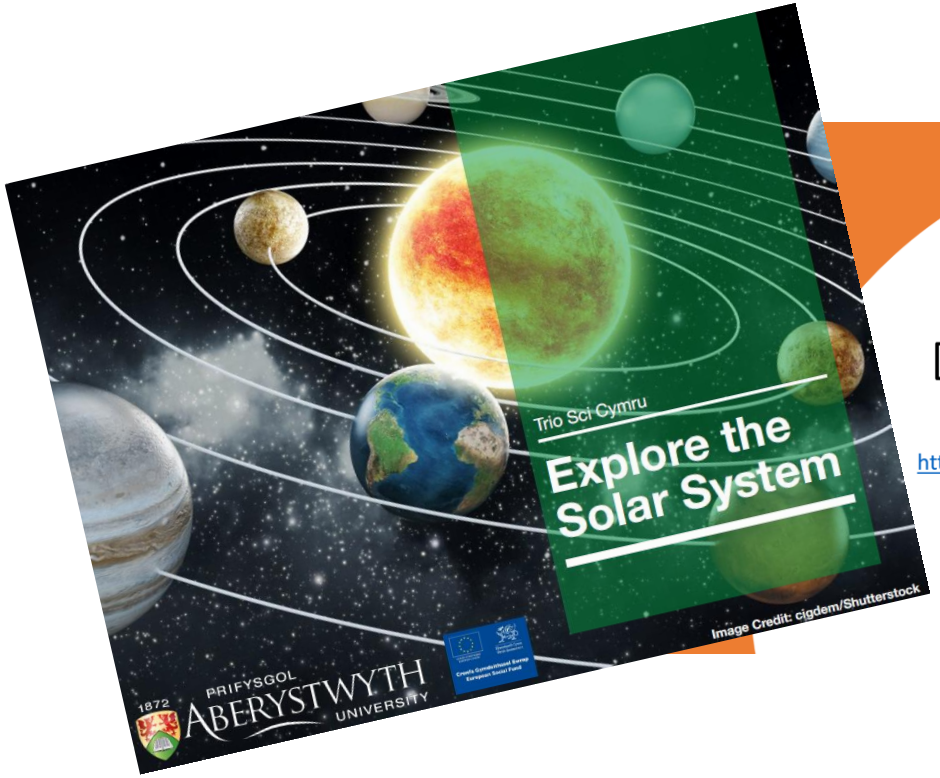


# Biology


G – Force
Let's investigate how we power a professional athlete
PRIFYSGOL ABERYSTWYTH UNIVERSITY
IBERS
Athrofa y Gwyddorau Biolegol, Amgylcheddol a Gwledig
Institute of Biological, Environmental and Rural Sciences
Cronfa Gymdeithasol Ewrop
European Social Fund


Geneious!
The amazing code for life
Let's investigate the incredible world of DNA
PRIFYSGOL ABERYSTWYTH UNIVERSITY
IBERS
Cronfa Gymdeithasol Ewrop
European Social Fund
Trio Sci Cymru
Name:
School:


Welcome to the fantastic world of parasites!!
School:
PRIFYSGOL ABERYSTWYTH UNIVERSITY
Cronfa Gymdeithasol Ewrop
European Social Fund
IBERS




Design a Mars Lander

Adapted from NASA

https://www.jpl.nasa.gov/edu/learn/project/make-an-astronaut-lander/

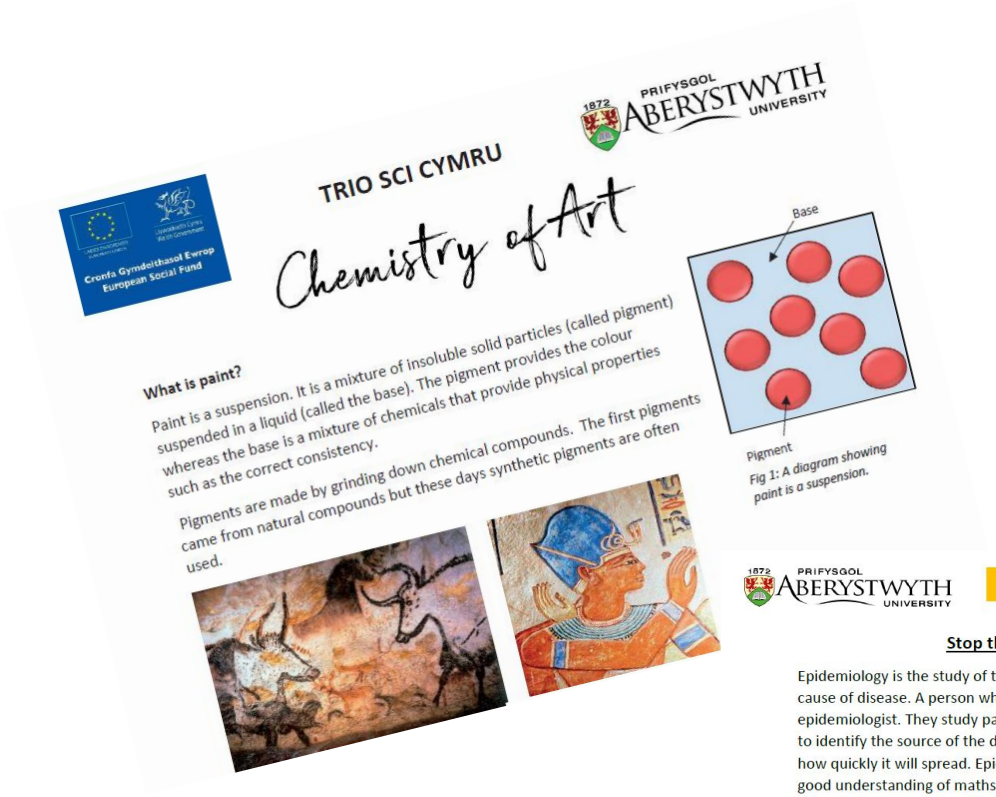
Cronfa Gymdeithasol Ewrop
European Social Fund

PRIFYSGOL ABERYSTWYTH UNIVERSITY

Trio Sci Cymru


# Physics

# Chemistry



TRIO SCI CYMRU

## Chemistry of Art

**What is paint?**

Paint is a suspension. It is a mixture of insoluble solid particles (called pigment) suspended in a liquid (called the base). The pigment provides the colour whereas the base is a mixture of chemicals that provide physical properties such as the correct consistency.

Pigments are made by grinding down chemical compounds. The first pigments came from natural compounds but these days synthetic pigments are often used.




Fig 1: A diagram showing paint is a suspension.






Trio Sci Cymru

**Stop the spread!**



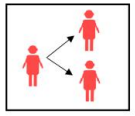
Epidemiology is the study of the distribution and cause of disease. A person who studies it is called an epidemiologist. They study patterns of disease to try to identify the source of the disease and to estimate how quickly it will spread. Epidemiologists need a good understanding of maths.

**Epidemic** – Many people in a community having the same disease at the same time.

**Pandemic** - An epidemic that has spread over several countries or continents.

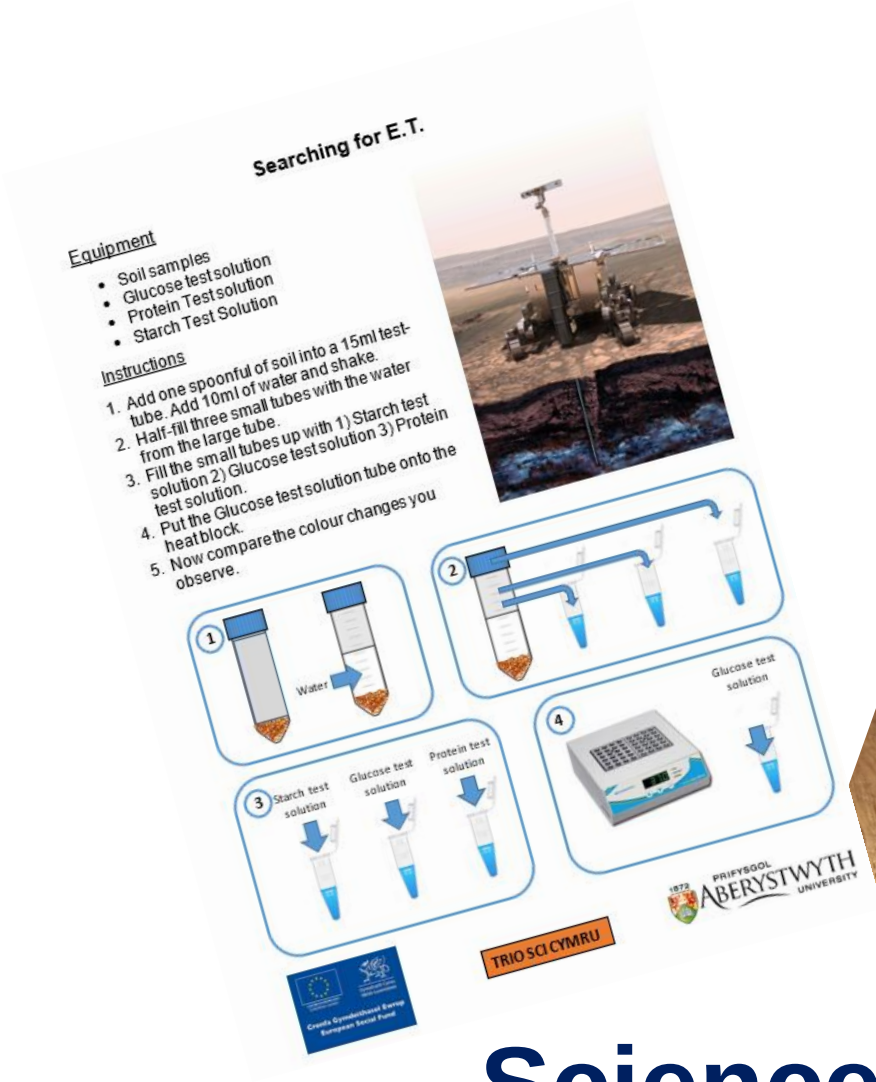
**Mathematical models:**

Maths can be used to "model" how the real world works. We will be using two models to forecast how quickly a disease spreads.



**Model #1: The standing game**

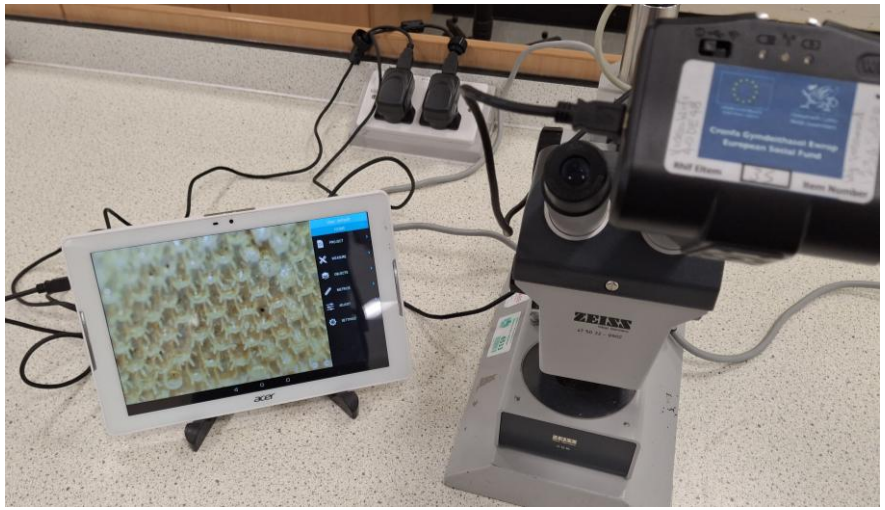
In this game, patient zero infects two others. The newly infected patient infects two others and so on. We say it has a reproduction number ($R_0$) of 2. Let's see how quickly the whole class gets infected!




# Science Clubs

# Items Purchased

## VR headsets

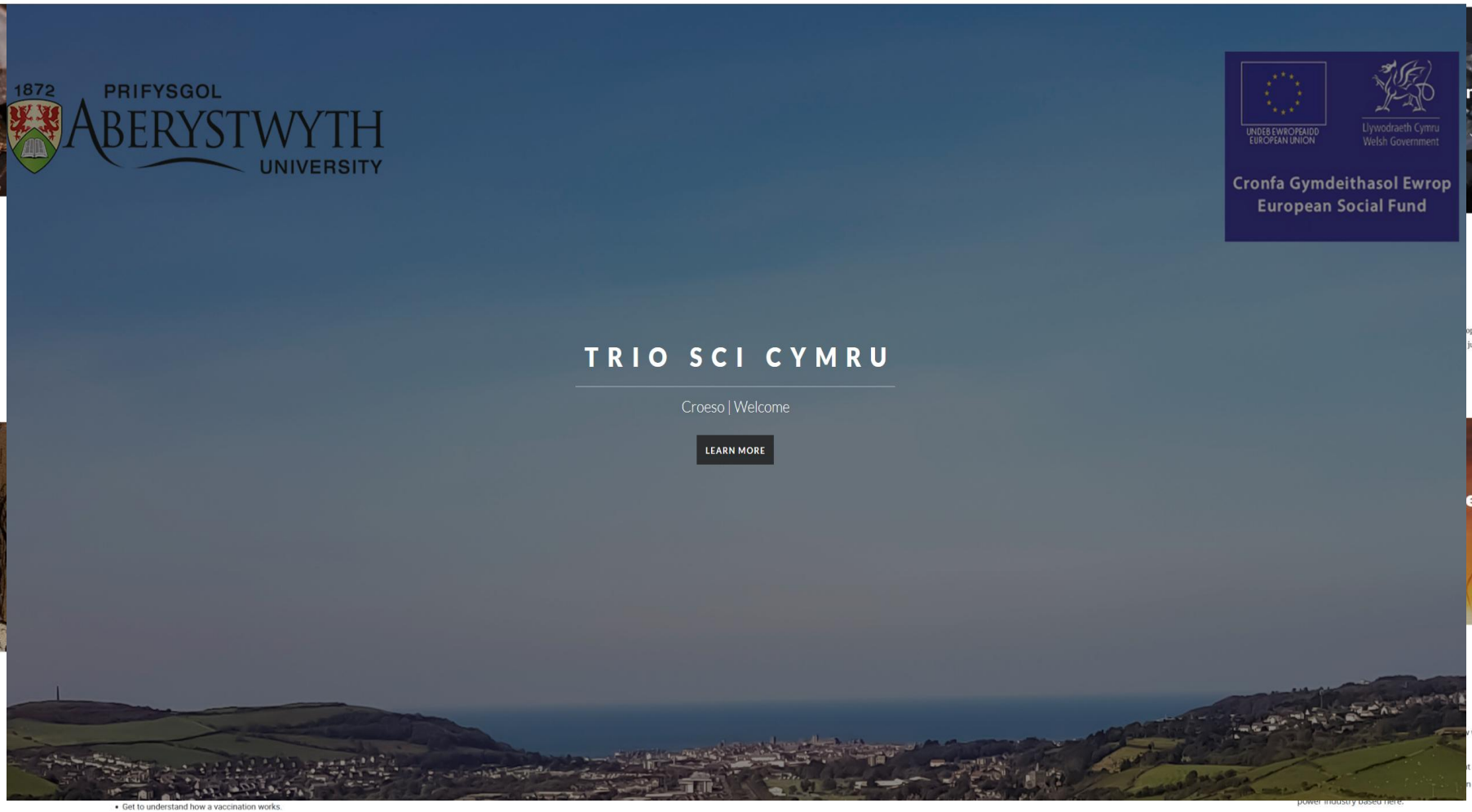



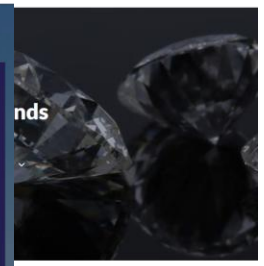

Tabcam microscope cameras



Planetarium

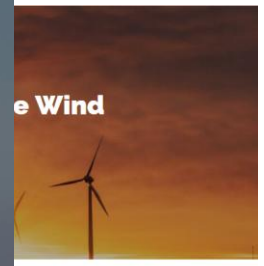
# Virtual Learning Environment



Nanodiamonds

operties and uses of nanosized diamonds
just diamonds that are smaller than 100




we generate it, before focusing

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• Get to understand how a vaccination works.

power industry based here.

https://schoolres.aber.ac.uk/

# Research background

Research on outreach focuses generally on:

- **Methodology –** Delivery style and resources
- **Outcomes of interventions –** e.g. increase in students' "Science capital"/change in attitudes (Barmby et al., 2008)

Less work has been done on what makes outreach successful from a school perspective

- **NCCPE** – Schools universities partnership initiative (Hamilton, J. and Hughes, P.M., 2017).

# Research team

Prof. Jo Hamilton, Scott Tompsett, Rachel Keeble, Carys Huntly

Dr. Lorrie Murphy, Delwen McCallum, Emma Withers

Prof. David Willock, Sarah Roberts, Corey Smith

# Research methodology

**Semi-structured interviews:**

Questions designed to identify:

- What teachers consider to be best practice
- What leads to the greatest change in attitudes to STEM subjects.

What was your experience of TSC? Which methods of outreach work and why?
Which factors do you think affect your students' attitudes towards STEM subjects and careers in STEM? How can we positively influence them?
How can collaboration between schools and universities work in the future?

# Research methodology

## Art Staging board activity:

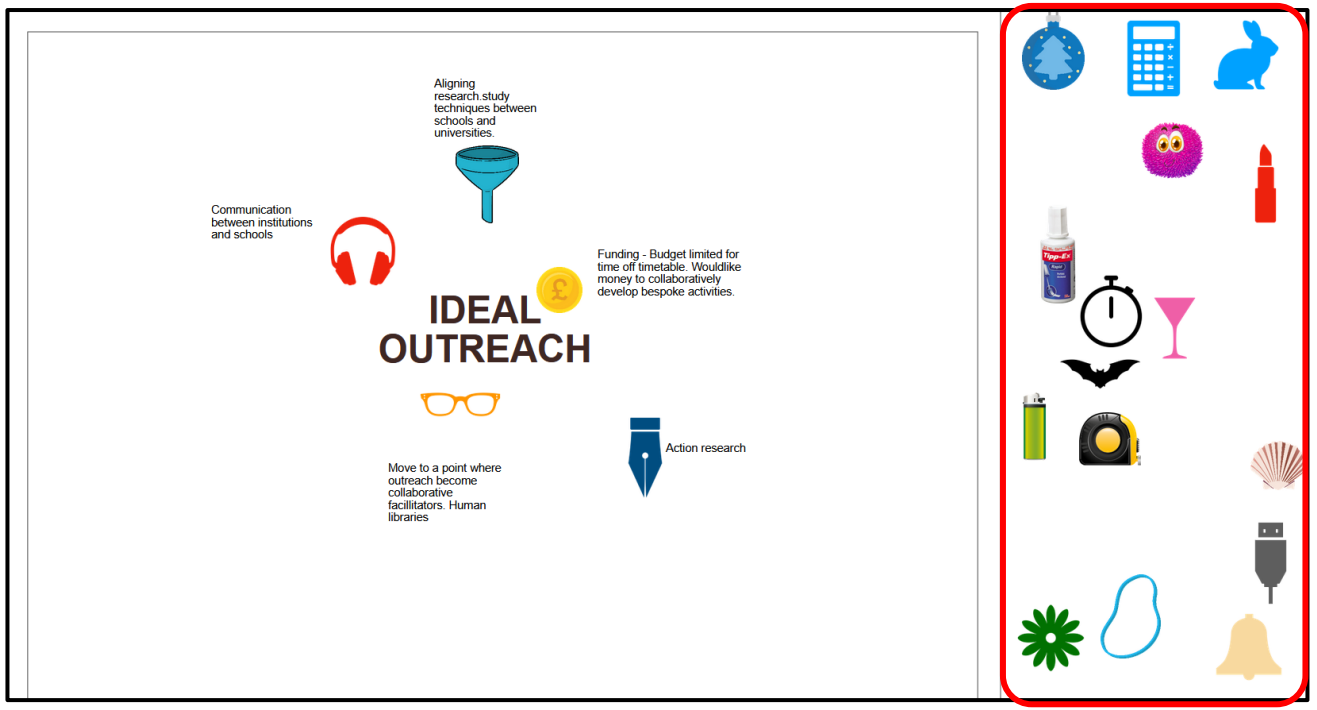
Aimed to explore teachers' broader experience of STEM outreach and identify what factors lead to successful

- Broadly based on centre-stage technique described by Williams and Keady (2012a, 2012b)
- Addition of visual props to follow the art-staging approach of Overs et al. (2022)

# Centre-Staging board activity:

Items positioned on board

Closer to centre = higher priority




Items to select and position on board

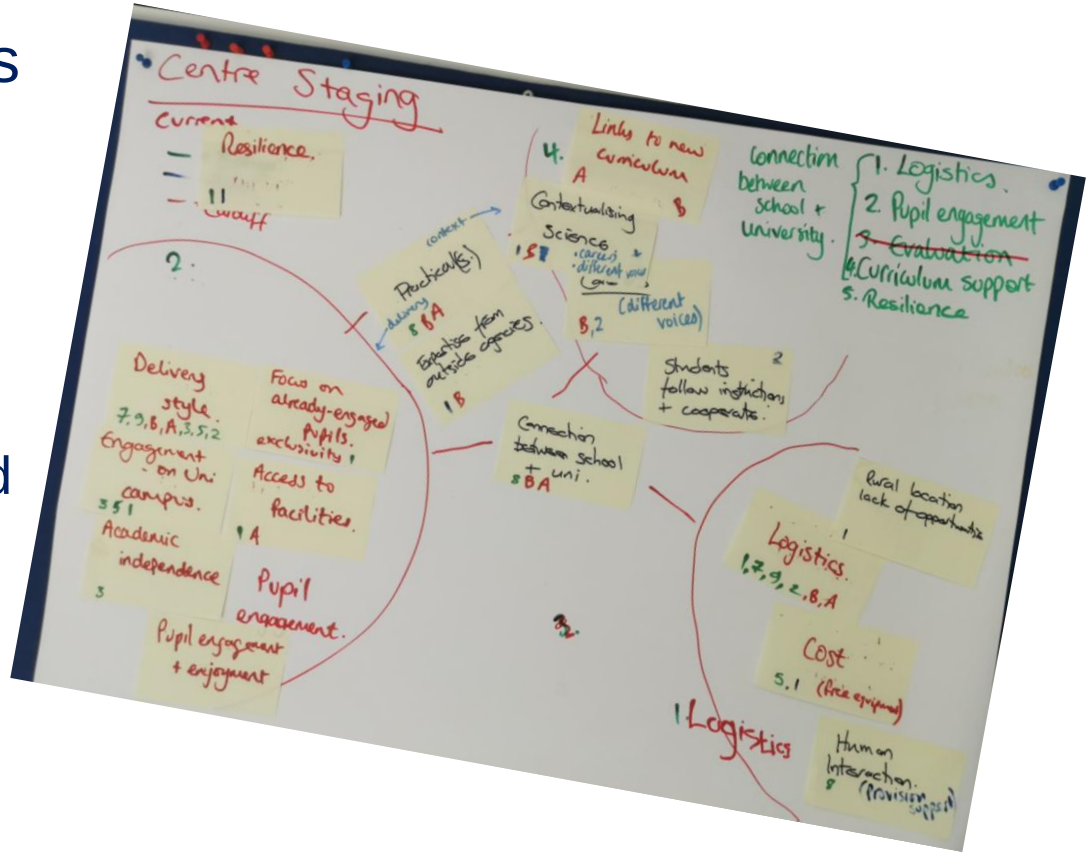
Interviewee assigns meaning to the object.

Due to COVID restrictions we used an online board created in Cacoo - https://cacoo.com and shared over MS Teams.

# Research methodology

9 interviews conducted autumn 2021 across Wales

- Interviews transcribed
- Positions of centre-staging activity collated
- Transcriptions coded
- Key concepts from semi-structured questions and centre-staging were identified



# Results

Themes from the semi-structured interviews and centre staging coincided

- **Logistics -** Costs in terms of time/money and resources attached to outreach
- **Pupil Engagement –** Most effective approaches in engaging students
- **Curriculum Support –** How outreach can support existing curriculum content
- **CPD –** How to engage with teachers to build relationships
- **Resilience –** Helping students to develop critical thinking skills
- **Structure-** What format should outreach take

Centre-staging benefits:

- Ability to rank comments based on priority
- Deeper commentary on key themes identified
- More emotion attached to comments

# Results

## Logistics

- Cost to schools in time and energy
- Whole day activities are a burden

- Schools have limited resources
- Free workshops essential
- Free materials welcomed
- Providing unobtainable equipment is highly beneficial

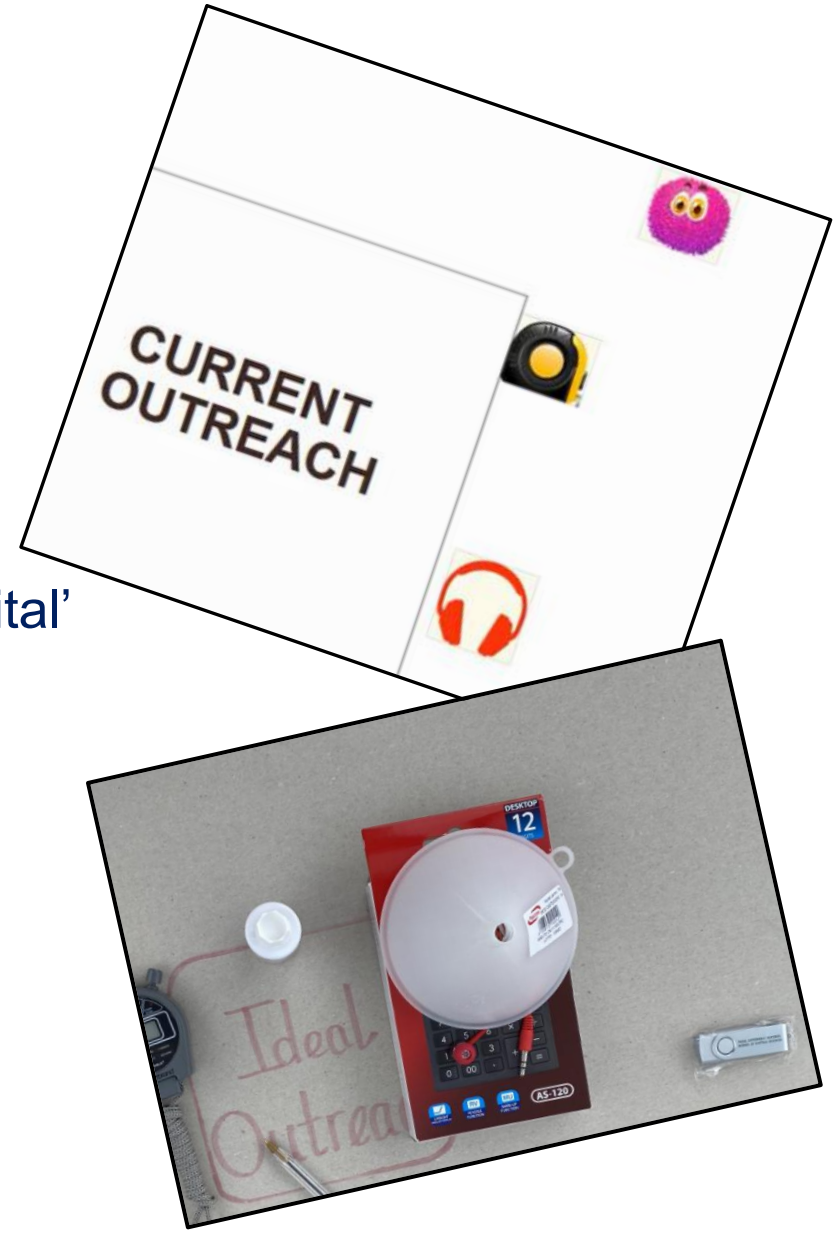
- Unrealistic perception of ICT facilities in schools

- Bilingual workshops appreciated across our region

# Results

## Pupil engagement

- “Fun”, hands-on practical activities
- Access to different equipment and facilities
- Applied science with local themes increase ‘science capital’
- Delivery by perceived experts
- Access to experts providing a different science “voice”



# Results

## Curriculum Support

- Outreach most useful when aligned with school curriculum/Exam specifications
- Cross-curricular activities work with the Curriculum for Wales (Curriculum and Assessment (Wales) Act (2021)
- Contextualising STEM outreach and linking it to future careers important
- Human libraries
- Potential for action research


*"Well, I would have thought (there is a) really good opportunity here .... with the new Welsh curriculum, because .....that's .....very much about looking at a topic from a holistic approach."*

# Results

## CPD

- Collaboration key to long-term success of outreach
- Teachers refresh knowledge on technical subjects e.g. molecular biology
- Support for teachers delivering outside of their subject specialism
- Co-development of resources to refine offering
- Fosters a trusting relationship between partners

# Results

## Resilience

- Provision of science role models
- Challenge students' view of science on social media
- Opportunities for students to explore science in a safe space where they don't have to be "right"
- Regular interactions with students may increase students' science capital

*They think science may be doctors, nurses, …. whereas it was a lot about agriculture, or engineering and I think it opened their eyes as to the many jobs that are out there."*

*… I think that's the challenge… it's not our job to tell them how to think. But it's our job to try and facilitate it and let them be evaluative of what information they're given.*

# Results

## Structure

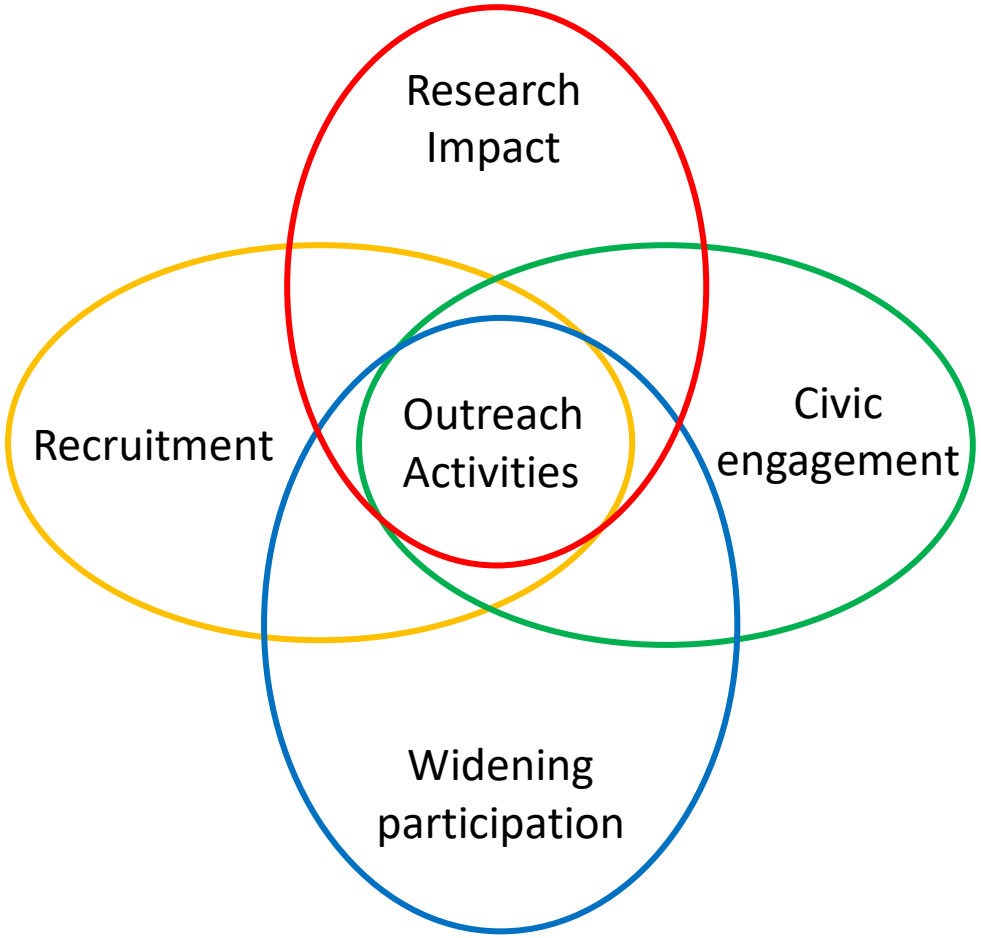
- Longitudinal delivery a good thing
- Developing long-term relationships with schools important
- Face to face activities more beneficial than alternatives
- Problem with grant funded activities that start and abruptly stop when funding ends

*There's a continuation from year to year. .....once you've organised .... the money ....., it's easy the following year.*

*Once you start working with somebody, once you're confident in them... I thought.... this is good... this is the right level, and works fine.*

# The future

- Ongoing school and FE outreach time consuming ***but*** sits in the middle of a number of core strategic priorities
- Requires a focused and coordinated response
- Long-term commitment – a slow-burn



# The future

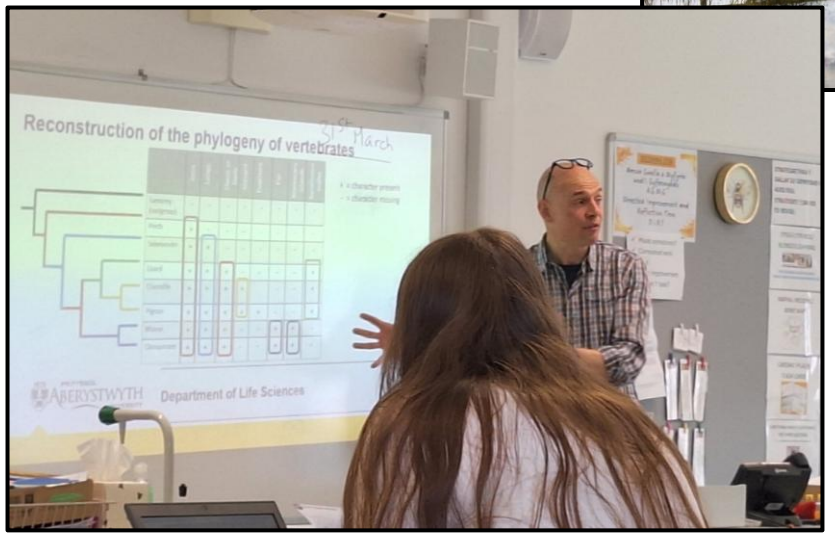
***Developing trusted partnerships for outreach:***

- Working with Bro Dinefwr School (Llandeilo)
- Highly engaged HoD
- Numerous cross-curricular projects

***Outbound workshops:***

- DNA Discovery
- Phylogenetics

Gaining feedback on content of workshops

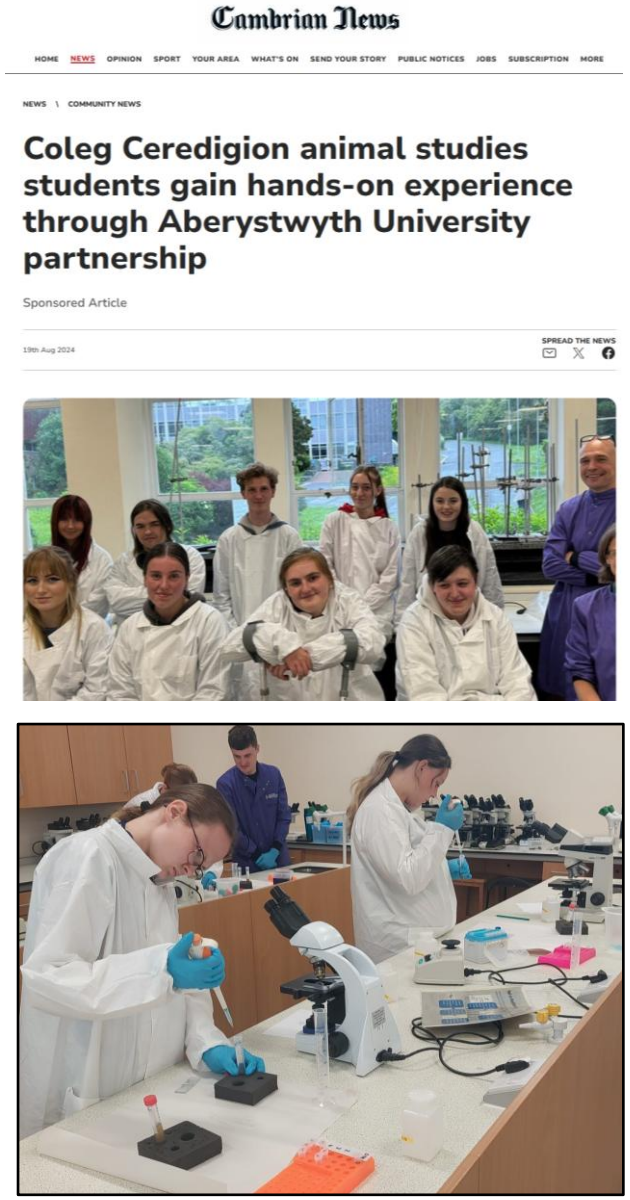


# The future

***GMSR team actively engaging on campus activities which are becoming increasingly popular post-pandemic***

***Bringing more schools and students onto campus:***

- *Llandovery College*
- *Oswestry School*
- *Ysgol Penweddig*
- *Ysgol Bro Teifi*
- *Coleg Ceredigion*
- *Reaching Wider*
- *Access All Aber*

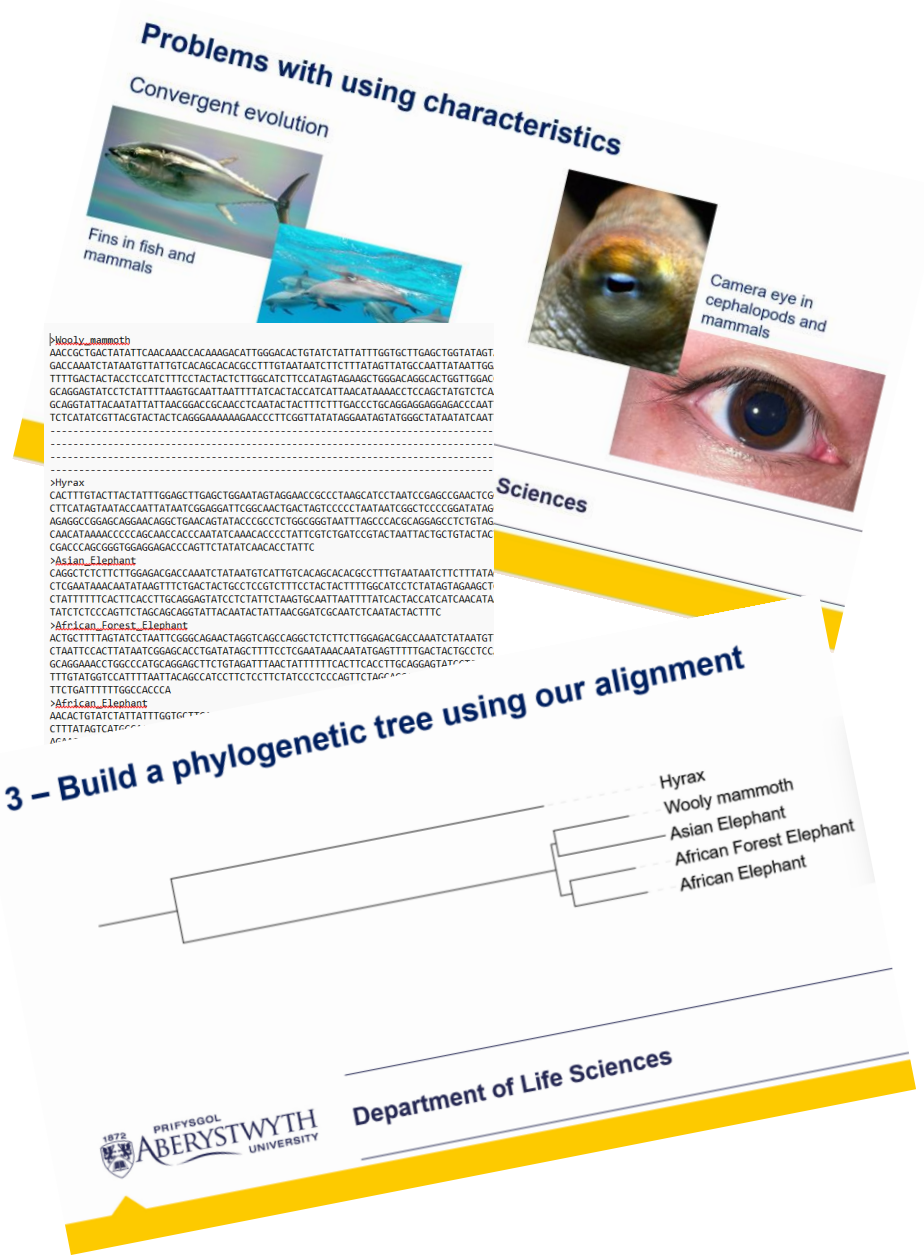


# The future

**Direct Outreach – time and energy intensive.**
**How can we reach our target with less input?**

- Development of resources that can be made available to teachers – Loan boxes of equipment / subject specific Powerpoints etc. and online activities e.g. Phylogenetics

- Engage schools via Teams calls (Human libraries)



# The future

Development of ***action research*** projects with schools:

**Insect populations -**

- School sampling of mown/vs unmown areas of school fields
- Opportunity to use equipment like our leaf blower insect sampler
- Links directly to the A-Level core practical activities
- Potential to grow this with multiple schools involved in data capture and analysis

# References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