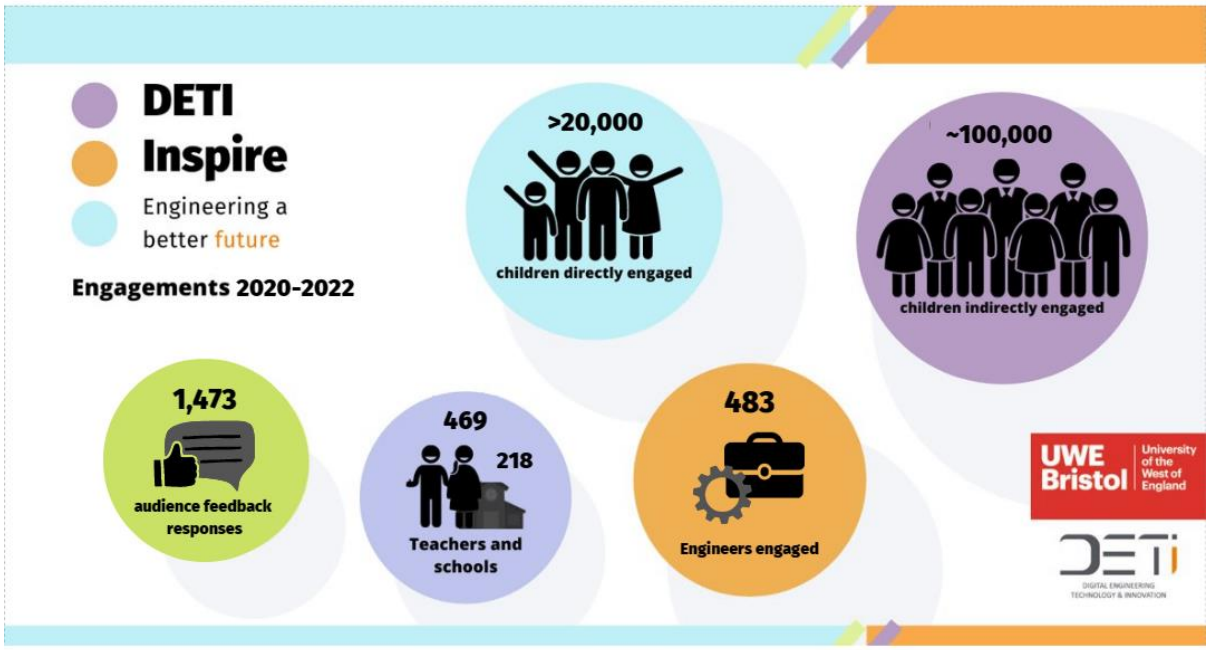
DETI Inspire Final Report



DETI Inspire Team

Summary of Engagements

September 2020-December 2022

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Led by Associate Professor Laura Fogg-Rogers

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DETI DIGITAL ENGINEERING TECHNOLOGY & INNOVATION

WEST OF ENGLAND Combined Authority

STEM AMBASSADOR HUB
STEM Ambassador Hub West England

UWE Bristol University of the West of England

Contents

1 Executive summary

Inspiring a future generation of engineers has never been more important, as we seek urgent solutions to the Climate Crisis. The West of England is leading the way developing sustainability solutions with academia and industry collaborating to reach Net Zero by 2030. These green jobs are vital to our regional economy as well as the future security of our world.

The DETI Inspire programme aims to catalyse green career accessibility and progression through enhanced STEM outreach, connected to the cutting-edge DETI industrial test cases. The programme has developed the Digital Trailblazers (secondary schools) and Curiosity Connections (primary schools) networks in the West of England and we are at the heart of innovative school and industry regional collaborative projects, with national partners for further reach. Using curriculum-linked engineering outreach and careers support, we are renowned for connecting children with real-life, diverse engineering role models to widen participation and aspirations for green STEM careers.

Encouraging diversity and inclusivity, DETI Inspire has engaged children in primary and secondary education across the West of England, with a focus on disadvantaged areas. From September 2020 to December 2022, DETI Inspire delivered a wide range of outputs and engagement activities. In two years, the team directly engaged over **20,206 children**, **469 teachers,** and **218 schools, with over 117,000 additional children reached through indirect dissemination efforts**. Along the way, children have been able to have conversations with real-life engineers through Q&A sessions, card games and skill shares. **483 engineers** have so far been part of the outreach, as well as at least **17 industry partners and three charities**.

Of those direct engagements, **5,787** young people have received at least one in-person, presented BoxED workshop with their school (The West in Minecraft, We Make Our Future, Engineering Curiosity, WeCount). Of those 5,787, **29%** (N=1,699) of the young people have been from schools in the two lowest IMD bands; i.e. areas representing the most deprived 20% of the country.

1,473 student feedback responses have been collected during the presenter-led workshops. From these responses, 58% of students engaged are female, versus 42% male. When asked to describe their level of interest in engineering before and after the session**, 'Very Interested' in engineering responses increased 39% from before the session to after** and 'Interested' increased by 11%. 'Neutral', 'Of Little Interest' and 'Not Interested' all decreased.

DETI Inspire will continue to deliver activities to schools across the West of England Combined Authority (WECA). We will provide much needed coordination for digital engineering and green career progression through our Diversity Demonstrator with support from STEM Ambassadors. We will champion green jobs and STEM careers to ensure the development of this vital industry for the West of England, enabling our region to work towards our goal of Net Zero 2030.

Associate Professor Dr Laura Fogg-Rogers, DETI Inspire Lead

Table 1 Summary of all engagements and estimated reach for this reporting period

	Children engaged directly	Estimated Indirect reach	Schools reached	Teachers engaged	General reach	Engineers involved	Outputs
Engineering Curiosity	821	4,070	93	116	1,700	75	Card set and activity delivery; 41 TikTok videos, STEM Ambassador Q/A
The West in Minecraft	2,948		47	112	*9,982**	-	Resources and activity delivery; Minecraft world
WeCount Schools	560	87,000	7	14	15,003	-	Resources and activity delivery; 10 sensors
Sustainability Solutions Summit	51	51	8	8	326	12	YouTube videos, Teacher and Student Summit Resource pack
We Make Our Future	1458	-	12	45	90	-	Science show
Cheltenham Science Festival	6400	19,280	80	80			Week of activities in engagement space in 2022
Website	-	-	-	-	5,684	-	22 new resources, 6 new stories, 20 new events
Newsletter	-	-	-	-	300	-	5 newsletters
Social media	-	-	-	-	366,539	-	100s of posts across three main channels
Advisory Panel	-	-	2	2	5	10	3 meetings
Digital Trailblazers	-	-	-	-	760	-	Website and app
Big Beam In	3,500	3,500	-	54	-	15	Tik-Tok, children's drawings
The Leaders Award	12	-	62	-	-	8	Children's ideas, student prototypes and prizes
Primary Engineer CPD	-	318	10	11	-	-	Training for teachers
Family Fun Day	300				300	10	Multiple activities for families in the School of Engineering building
Like To Be	-	-	-	-	583	14	Careers Network Event Platform
Community STEM Clubs	180	180	-	-	-	5	3 STEM clubs, 2 ongoing
Bristol Robotics Festival	130	130	1	1	638	50	10 events
South West STEM Fest	-	5,500	-	-	-	48	59 events
Routes into STEM panel	200	200	-	-	-	4	Knowledge exchange
Great Science Share	225	225	2	8	-	-	Viewing of We Make Our Future
Sustainable Transport Day	97	97	10	18			Day of activities, school project showcase
Diversity Demonstrator	-	-	-	-	-	102	Network of 102 members
Soapbox and Woodspring Wings Festivals	414						Engagement activities on stalls at local festivals
Women Like Me	-	830	-	-	-	30	Mentoring of 15 engineers
YAP Climate Action	12		-	-	-	-	Climate communications training
UWE Engineering Building	-	-	-	-	-	100	Opening of new building
Air League	2,906	-	-	-	-	-	Adapted Minecraft
Totals	**20,206**	**117,000**	**218**	**469**	**391,928**	**483**	

2 DETI Inspire

DETI Inspire is managed by UWE Bristol's School of Engineering in partnership with the Science Communication Unit, with funding from the initiative for Digital Engineering Technology & Innovation (DETI). The project is run in collaboration with the West of England STEM Ambassador Hub, operated by Graphic Science.

2.1 Initiative for Digital Engineering Technology and Innovation

Running from July 2020-2022 as a two-year, research and development (R&D) initiative in the West of England, DETI has collaborated with advanced engineering companies and digital technology pioneers to make digital transformation a reality for companies across the region, and beyond – cementing the UK's place as global leader in digital engineering and low carbon economies. DETI was funded by the West of England Combined Authority & Local Enterprise Partnership through the Local Growth Fund, administered by the West of England Combined Authority. This funding of £5m was matched by industry and HVM Catapult.

2.2 Engineering a better future

To achieve net zero and a low carbon global economy, everything we make and use will need to be completely re-imagined and re-engineered[1]. There is an urgent need for future graduates and employees with green skills underpinned by STEM knowledge and applications[2]. This transition needs to be in partnership with our diverse communities and education networks[3].

However, women make up just 12% of Engineers, 24% of physical science undergraduates and 26% of the UK Science, Technology, Engineering and Mathematics (STEM) workforce[4], despite making up 51% of our population[5]. People from Black, Asian and Minority Ethnic backgrounds account for 17% of undergraduates in the physical sciences[6], but only 7% of employed engineers[7] (despite being 13% of the UK population). People from low socio-economic backgrounds or those with specific learning difficulties also find it harder to access education and careers in engineering.

[1] Fogg-Rogers, L., Richardson, D., Bakthavatchaalam, V., Yeomans L, Algosaibi N, Lamere M, Fowles-Sweet W. Educating engineers to contribute to a regional goal of net zero carbon emissions by 2030. In: Le développement durable dans la formation et les activités d'ingénieur [Internet]. Nantes, France; 2021. Available from: https://uwe-repository.worktribe.com/output/7581094

[2] Institute of Physics. Limit Less - Support Young People to Change the World. 2020.

[3] Fogg-Rogers L, Hayes E, Vanherle K, Pápics PI, Chatterton T, Barnes J, et al. Applying Social Learning to Climate Communications—Visualising 'People Like Me' in Air Pollution and Climate Change Data. Vol. 13, Sustainability . 2021.

[4] WISE Campaign. Women in the UK STEM workfoce [Internet]. 2019. Available from: https://www.wisecampaign.org.uk/statistics/women-in-the-uk-stem-workforce/

[5] Institute of Physics. Students in UK Physics Departments. 2018.

[6] EngineeringUK. The state of engineering. 2017.

[7] Diekman AB, Clark EK, Johnston AM, Brown ER, Steinberg M. Malleability in communal goals and beliefs influences attraction to stem careers: Evidence for a goal congruity perspective. Vol. 101, Journal of Personality and Social Psychology. 2011. p. 902–18.

Both recruitment and retention are important – more people need to connect with STEM industries as socially conscious and collaborative disciplines, and at a younger age before stereotypes are ingrained[8], and more employees need to be supported to make a difference in the workplace[9]. Particularly following the impact of COVID-19 lockdowns, teachers and schools have reported that curriculum and industry-linked education experiences are more vital than ever – enhancing the cultural capital and development of young people in the West of England.

2.3 DETI Inspire Sustainability

Encouraging diversity and inclusivity, DETI Inspire has engaged children in primary and secondary education across the West of England, with a focus on disadvantaged areas. Using curriculum-linked engineering outreach and careers support, we have connected children with real-life, diverse engineering role models to widen participation and aspirations for STEM careers.

The programme has developed the Digital Trailblazers (secondary schools) and Curiosity Connections (primary schools) networks in the West of England. The programme has pioneered outreach activities designed to be more appealing to the needs, values, and issues of relevance for under-represented groups in the physical sciences. The outreach builds on research about recruiting and retaining women in engineering,[10] by showing how STEM industries can contribute to societal goals, helping people and planet.

Representation and diversity of presenters is critical[11], and the programme has built a network of Diversity Demonstrators, including women, people from Black and Asian backgrounds, neurodiversity, and non-traditional education routes. DETI Inspire has supported the Women in Science and Engineering Ten Steps, the Women's Engineering Society, the Association for Black and Minority Ethnic Engineers, and the Tomorrow's Engineers Code.

We aim to continue to break stereotypes and challenge perceptions about careers in engineering, inspiring a greater number and more diverse set of young people into the engineering workforce to shape our shared future.

[8] Stout JG, Dasgupta N, Hunsinger M, McManus M a. STEMing the tide: using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). Journal of personality and social psychology. 2011;100(2):255–70.

[9] Bristow A, Fogg-Rogers L. What is an engineer anyway? Digital Now. 2021;17.

[10] Fogg-Rogers L, Hobbs L. Catch 22 - improving visibility of women in science and engineering for both recruitment and retention. Journal of Science Communication. 2019;18(4).

[11] Fogg-Rogers L, Sardo M, Boushel C. Robots vs Animals: establishing a culture of public engagement and female role modelling in a multi-disciplinary engineering laboratory. Science Communication. 2017;39(2).

3 Engagement summary

3.1 Geographic reach

A critical aspect of the DETI Inspire programme has been the development of digital engineering education outreach activities - a portable programme of activity which can be run in schools and community groups.

5,787 young people have received at least one in-person, presenter-led Inspire workshop, which includes The West in Minecraft, We Make Our Future, Engineering Curiosity and WeCount. In total, 180 of these workshops have been delivered by the DETI Inspire team. This represents **68 schools and community groups** (see **Error! Reference source not found.**).

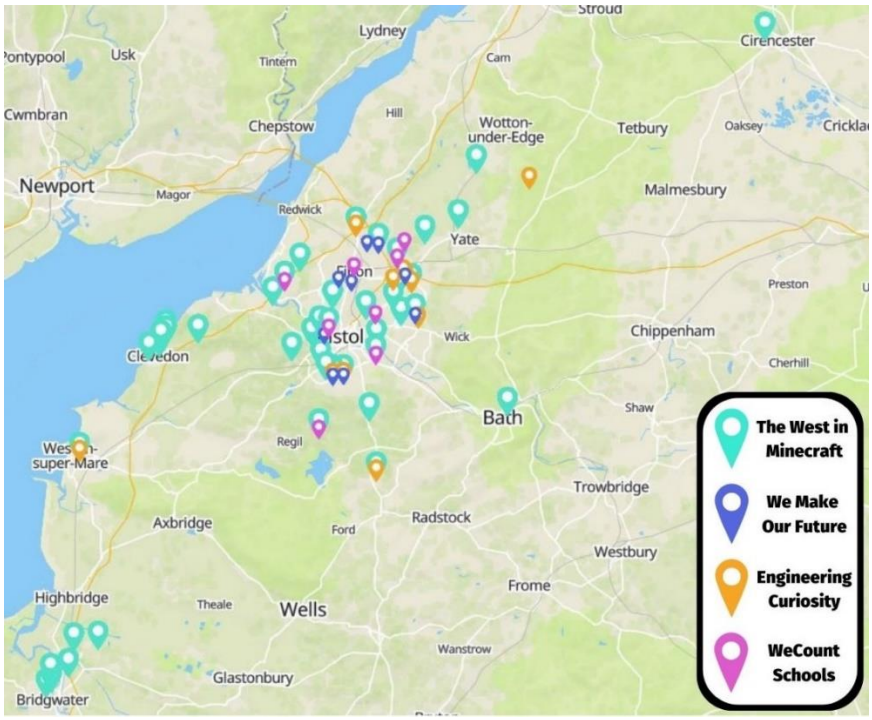

Figure 1 Locations of the schools and community centres engaged with DETI Inspire sessions. Note: Where schools have received multiple activities, location colour shows most recent engagement.

Table 2 – Schools to have received at least 1 BoxED session during period up to August 2022

Alexander Hosea	Deerhurst	Our Lady of Lourdes CoE
All Saints Primary Clevedon	Digitech studio school	Patchway
Appleby Primary	Elm Park Primary School	Pensford School
Ashton Gate Primary School	Filton Ave Primary	Puritan Primary
Ashton Park School	Frome vale Academy	Richard Huish College
Baileys Court	Hambrook Primary	Science Share/LEGO League
Barley Close	Hans Price Academy	SGS Pegasus
Bedminster Down School	Hareclive E-Act Academy	Sheldon School
Birdwell School	Hawkesbury School	Shield Road Primary
Bradley Stoke Community	Horfield Primary	St Katherine's School
Bridge Learning Campus	Hotwells Primary	SS GB Future Brunels
Bristol Cathedral School	Kings Oak Academy	St Nicholas Chantry
Bromley Heath Infant School	Little Stoke Primary	Summerhill Infants
Broomhill School	Mary Elton School	Tickenham Primary
Cameley Church Primary	Mendip Studio School	Tyndale Primary School
Chew Valley	Merchants Academy	Watermore Primary School
Chilton	Minerva Primary	Westover Green
Christchurch Infants	Northgate Primary	Whitehall Primary
Christchurch Junior	Oasis Bank Leaze	Widcombe Junior School
Cirencester Big Bang	Oasis Brightstowe	Willowdown Primary
Clevedon School	Oasis Brislington	Woolavington VIllage Primary
Cotham School	Old Library STEM Club	Yeo Moor Primary
Crockerne	Orchard School	

3.2 Diversity of locations

31% (30.7%) of all West of England Combined Authority (WECA) schools and community groups engaged in DETI Inspire workshops came from areas within the most deprived 20% of the country[12] (ie. IMD score 1 or 2).

5,787 young people have received at least one in-person Inspire workshop either the West in Minecraft, We Make Our Future, Engineering Curiosity or WeCount. Of those 5,787, 31**%** (N=1,699) of the young people have been from schools in the two lowest IMD bands; i.e. areas representing the most deprived 20% of the country.

[12]According to the 2019 UK Government Index of Multiple Deprivation (IMD)

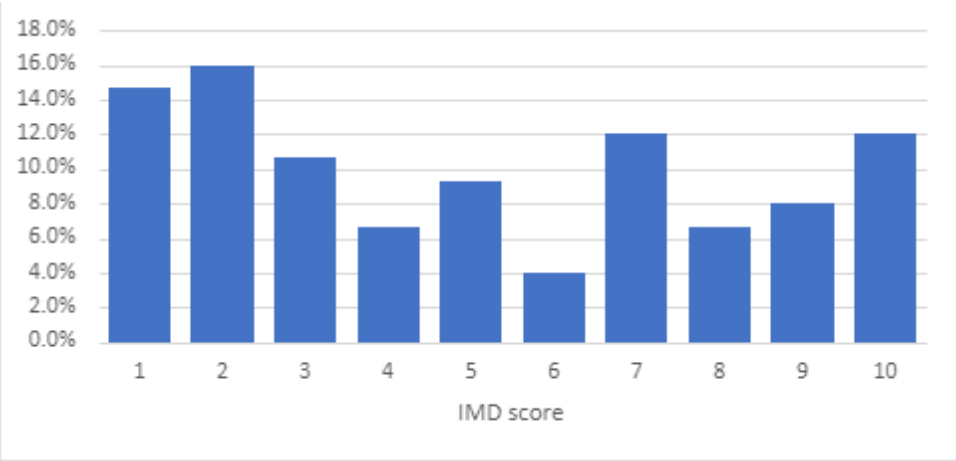

Figure 2 Graph showing IMD score of schools and community groups to receive Inspire workshops

3.3 Primary and secondary schools

The priority for DETI Inspire was to reach out to and engage with children of primary and secondary school age. To do this, the team connected with schools from across the region, contacting via internal and external newsletters, social media, and partnership linkages.

During the period up to August 2022, Key Stage 2 (upper primary school) has been significantly the most reached age group, with 20% of total engagements being with year 5, and 19.4% being year 6. This means that a total of 70.3% of engagements have reached primary school audiences, and 29.7% have reached secondary school audiences.

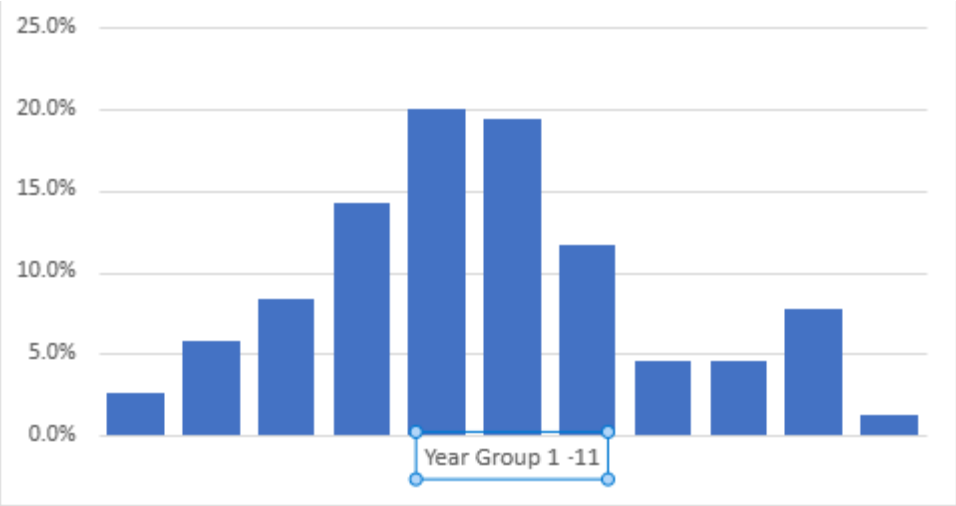

Figure 3 Graph showing percentage of engagements with Inspire sessions by year group

3.4 Industry Partnerships

A social network analysis was performed for all the school-industry connections made through DETI Inspire, using a free tool called Social Network Visualiser. The resulting social network displays the strength of connections between groups and organisations and highlights engagement hotspots.

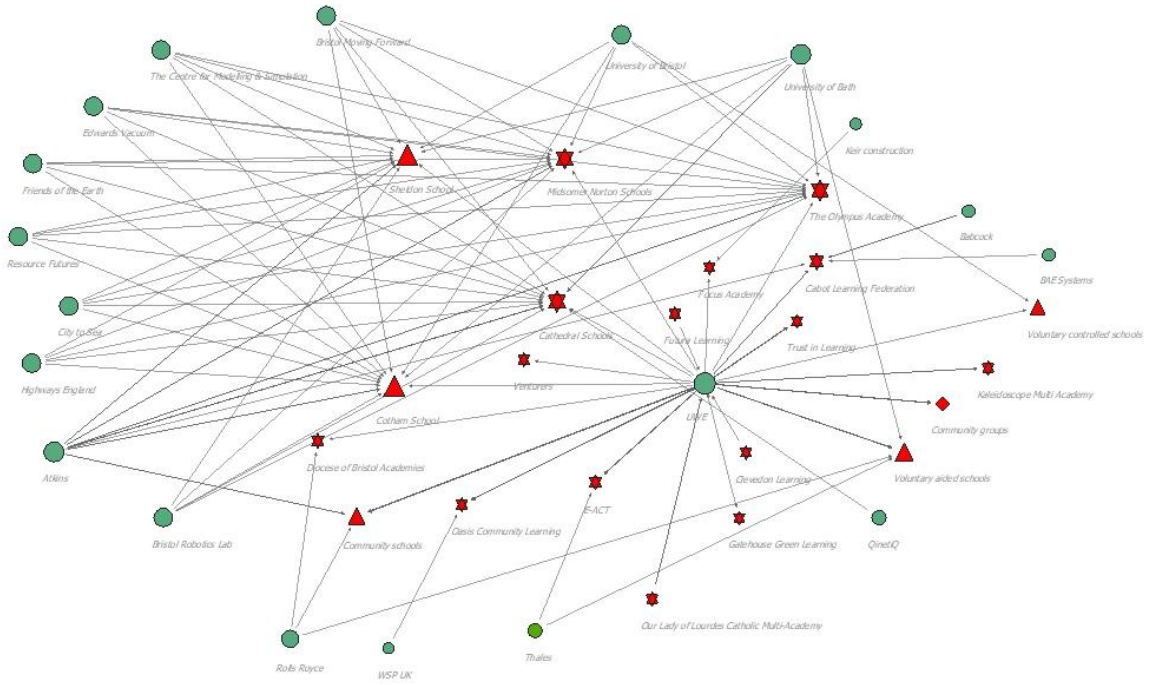

Figure 4 Network Diagram showing information centrality between industry partners, charities, schools and community groups. Made in Social Network Visualiser.

17 industry partners and three charities have engaged with a total of 50 schools or community groups across the WECA region and beyond, representing 72% of all the schools/groups involved in digital or physical engagements DETI Inspire. The above image (created on SocNetV 3.0.4) shows the centrality of information flows[13] between these industry partners (green circles) and the 21 school Trusts and Partnerships (depicted as red stars) and related organisations (triangles and diamonds) to which these 50 schools/groups belong. The stronger the information flow, the larger the icon.

As can be seen in the diagram, a lot of connections stem from UWE Bristol (in the centre right) and the industry partners that participated in the Big Beam In and the YEESS summit (top left). Schools that have only taken part in UWE-led lessons are without wider industry connections (e.g., Clevedon Learning Trust). The thickness of arrows indicates how many times an engagement was made, and the arrowheads (e.g., single or double) represent the flow of information. So, for instance, while Greenhouse Green Learning Trust (GGLT) only connected with UWE, it had a two-way exchange of information as it visited UWE and UWE visited a GGLT school.

[13] Degree of information centrality is a way to show how prominent each actor (node) is inside a network in terms of the sharing of information (in this case professionals' and children's' knowledge). Mapping is a useful way to visualise what is happening within a system and to observe patterns within and connections between the data.

To put this in perspective, there are more than 80 employers with representation in the STEM Ambassador programme in the WECA region. 19 (24%) of these employers participated in DETI Inspire.

Table 3 Employers represented in the West of England STEM Ambassador programme, grouped according to number of staff enrolled in the programme. Employers highlighted in bold represent those that have so far participated in DETI Inspire (with 5+ STEM ambassadors).

50+ STEM Ambassadors	15+ STEM Ambassadors	5+ STEM Ambassadors	
AECOM	**ARCADIS UK**	Alderley Systems Limited	L3 MAPPS
Airbus	**Arup Group**	Balfour Beatty	Leidos
Armed Forces	Assystems UK	BASF UK	Leonardo MW
Atkins - SNC Lavalin	AstraZeneca	BMT	**Network Rail**
Babcock	BMT Defence Services	Boeing	North Bristol NHS Trust
BAE Systems	**BuroHappold Engineering**	CFMS	Nucleargrads
DE&S	Capita Group	Copper Consultancy	**QinetiQ Group**
EDF Energy	Cavendish Nuclear	Crux Product Design	Ramboll
Jacobs	Curtins Consulting	Delphi Diesel Systems	Royal United Hospital Bath NHS
MBDA UK	Edwards	Etex Building Performance	RSK ADAS
Ministry of Defence	Frazer-Nash Consultancy	Evona	SCISYS
Renishaw	Hanson UK	General Electric	SPP Pumps
Rolls-Royce	Hewlett Packard	GKN	SUEZ
University of Bath	**Highways England**	Hoare Lea	Sweco
University of Bristol	Just Eat	Hyder Consulting	**Thales Aerospace**
WSP Group	Magnox	Hydrock	**Thatchers Cider**
	Mott MacDonald	**IBM UK**	Turner and Townsend
	National Composites Centre	Infineon Technologies UK	University Hospitals Bristol NHS
	Schlumberger	JN Bentley	Viper Innovations
	Schneider Electric	John Wainwright & Co	Wales and West Utilities
	Siemens	**Kier Group**	
	SPTS Technologies		
	Stantec		
	University of the West of England		

The STEM Ambassador population in the WECA region is diverse, and well-placed to deliver as role models in the DETI outreach programmes. In WECA, 73% of STEM Ambassadors are aged 17 - 35 compared to 37% UK population as a whole (Office for National Statistics). 40% of STEM Ambassadors are female, compared to 24% of the UK STEM workforce, while 17% of STEM Ambassadors are categorised as from Black, Asian or Minority Ethnic backgrounds compared to 14% UK population as a whole (Diversity UK).

3.5 Diversity Demonstrator and Women Like Me

To enhance the network of diverse STEM Ambassadors in the West of England, DETI Inspire launched the Diversity Demonstrator network in September 2020. This network of diverse engineering role models is formed of volunteers from local engineering industry and academia, all of whom can be called upon to champion engineering public engagement and inspire the next generation of digital engineers. To date, **102 members** have joined the network, with many members actively taking part in Inspire outreach activities with local schools and community groups and participating in linked programmes such as the Women Like Me mentoring project.

Women Like Me pairs senior (more than five years in industry) female engineers with junior (less than five years in industry) female engineers from across the West of England. The senior engineers provide mentoring to the junior engineers, and the junior engineers undertake outreach activities. Women Like Me has been operational since 2018 and has, to date, engaged around 192 engineers, from over 40 companies and reached around 12,300 children through outreach activities.

In 2020-2022 Women Like Me operated as part of DETI Inspire, and paired 46 senior engineers with 46 junior engineers, representing 22 companies. A minimum of 830 children were reached through outreach activities. All engineers enrolled in the 2020-2022 rounds also signed up to the Diversity Demonstrator.

3.6 Student Impact

University students have been recruited throughout the DETI project in order to role model being diverse real-life engineers, with young people meeting the student ambassadors during outreach activities and events. Although early on in their careers, the shorter age-gap has meant students have been truly relatable role models for young people.

By taking part in the ambassador scheme, the 27 students from the University of the West of England (13 female, 15 from Black, Asian, and minority ethnic backgrounds) have received training and feedback in communicating with younger audiences, developing their own skills and confidence, in order to continue being the positive and diverse role models that the industry needs.

To widen this work, the DETI Inspire team actively engages and supports students in other outreach projects – the impact of which is summarised in the infographic below.

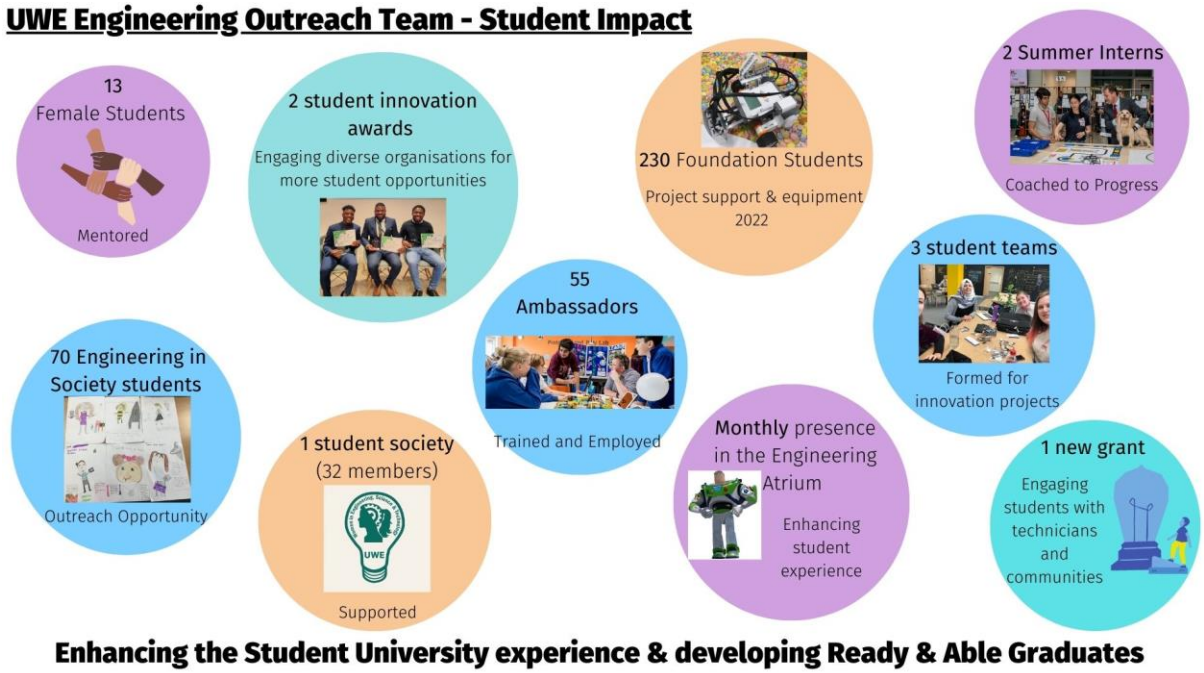

Figure 5: Benefits for university students through participating in the DETI Inspire project

Of particular note was the extended work with two student interns during the summer of 2022. The two students supported a vast range of outreach activities and events, as well as finding time to develop a new "Curious Robots" workshop. These internships gave the DETI Inspire team plenty of opportunity to provide feedback and support the students' development of core communication and leadership skills needed in the workplace.

Figure 6: Student interns Luca and Natalie engage West of England Mayor Dan Norris in the challenge they've set children in their new workshop - read more about their internship here: https://blogs.uwe.ac.uk/engineering/our-amazing-interns/.

4 DETI Inspire Outreach Activities

A critical aspect of the DETI Inspire programme has been the development of digital engineering and sustainability education outreach 'BoxED' activities - a portable programme of activity which can be run in schools and community groups.

From launch to August 2022, 5,787 4-16-year-olds (33% of total direct engagements) were engaged directly through in-person sessions developed by DETI Inspire: The West in Minecraft (N=2,948, 51%), Engineering Curiosity (N=821, 14%), WeCount (N=560, 10%), and We Make Our Future (N=1458, 25%).

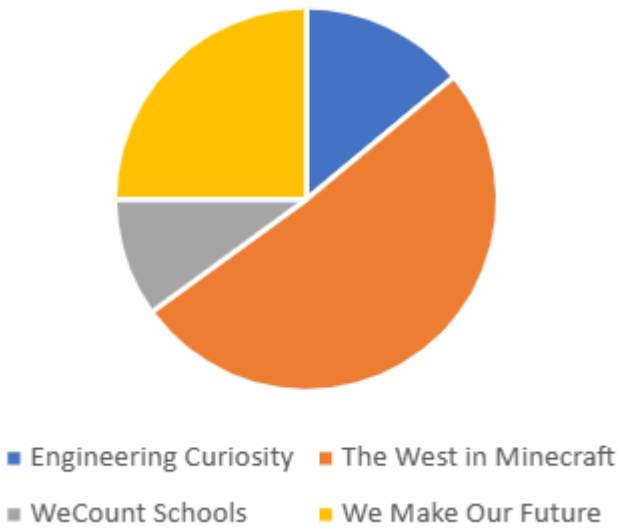

Figure 7 Proportion of engagements involved in each outreach activity.

4.1 Engineering Curiosity Cards

Research indicates that children need to see a wide variety of role models in order to enhance their social capital and identification with people in STEM[14]. A critical DETI Inspire resource has therefore been the development of new role modelling career cards for KS2 and KS3 children.

DETI Inspire collaborated with **MyFutureMyChoice**, an educational charity which aims to promote engagement and connection with STEM careers. The collaboration culminated in a card game (in the style of Top Trumps) activity showcasing the wealth of different engineering roles and opportunities available. The cards show a great diversity and variety of engineers, with accompanying skills, background context, and colourful illustrations.

[14] Fogg-Rogers L, Hobbs L. Catch 22 - improving visibility of women in science and engineering for both recruitment and retention. Journal of Science Communication. 2019;18(4).

Figure 8: Over half of the Engineering Curiosity cards are made up of women

The engineers depicted on the cards are based upon real engineers working in the West. To describe their job and determine their Top Trump scores, the engineers were interviewed about their route into engineering, as well as their skill set. Conscious effort was made to include more females and people from Black and Asian backgrounds, as they are underrepresented in the field. The diversity of people, careers and workplaces is intended to challenge perceptions of engineers and the jobs available in STEM, and show the children that people like them are part of Engineering.

Each card is also accompanied by a short Tik-Tok style video, made by the engineers themselves, showing them at work or talking about their role. The videos are fun and light-hearted, intending to further cement the conception that engineers are real people and that they come from a wide range of relatable skills and backgrounds. In total, **40 videos were made and have so far been viewed by over 1,700 people**. The videos can be accessed through the [DETI Inspire YouTube channel](#).

Figure 9: A photo showing the full Engineering Curiosity cards

In addition to the card pack, a full set of lesson plans, assembly ideas and activities were developed for use with KS1, KS2 and KS3 classes. The resources are designed to work best with live interaction and support from a STEM ambassador or student engineer, however they also include suggestions on how to deliver online. Depending on time, the activities can be delivered individually, in bite-sized chunks, or integrated into a themed curriculum. The cards, lessons and resources were first used in the Big Beam In event (discussed later in this report) during British Science Week, in March 2021, and are available to freely download from the **Curiosity Connections website**.

Since the Big Beam In, the Engineering Curiosity cards have been offered for free to every school involved. **327 packs have been sent out to 79 different schools and community groups**. Assuming that at least 1 class of around 30 pupils have engaged with the card pack sent to each school, gives a potential indirect reach of 2370. In the case of Easton community STEM club, the cards have been used by its sister project Omid, set up to support Afghan refugees over the holidays.

The cards and resources have also been used directly as a DETI Inspire outreach programme, featuring real-life engineering role models, **delivered to 38 classes in 14 schools, equating to over 820 children in Years 3-8.**

Table 3: List of schools to receive an Engineering Curiosity BoxED workshop in period up to Aug'22.

Frome Vale Academy	Barley Close	Our Lady of Lordes
Christchurch Infants	Hans Price Academy	Hareclive E-Act Academy
Patchway	Cameley Church Primary	Bridge Learning Campus
Bromley Heath Infant	Digitech Studio School	Clevedon School
Hawkesbury	Filton Avenue	

Beyond August 2022, the DETI Inspire team has also partnered with the South Gloucestershire Libraries group, to bring Engineering Curiosity sessions to KS2 school groups in libraries. The team

has to date provided 12 Engineering Curiosity sessions to 12 different South Gloucestershire schools. This represents **around 360 Year 6 students**.

Figure 10: Josh Warren from the DETI Inspire team running collaborative outreach sessions with South Gloucestershire Libraries..

4.2 The West in Minecraft

This activity was developed in collaboration with the well-established **Science Hunters** programme, through their engineering strand **Building to Break Barriers**, based in UWE Bristol's Science Communication Unit and funded by the Royal Academy of Engineering Ingenious scheme. It draws upon the programme's evidence that, in combination with their specially designed approach, Minecraft is effective in engaging children on scientific issues, particularly with children with additional educational needs. The DETI Inspire team linked to this work to develop new resources, following the programme's successful approach, to teach about digital engineering and the engineering design process, called 'The West in Minecraft'.

The team worked with engineers from **Atkins** who were able to map Ordnance Survey data into Minecraft, resulting in accurate replicas of Bath and Bristol. This Minecraft 'world' was then brought to life with landmarks in the West of England (Clifton Suspension Bridge, SS Great Britain, Bristol

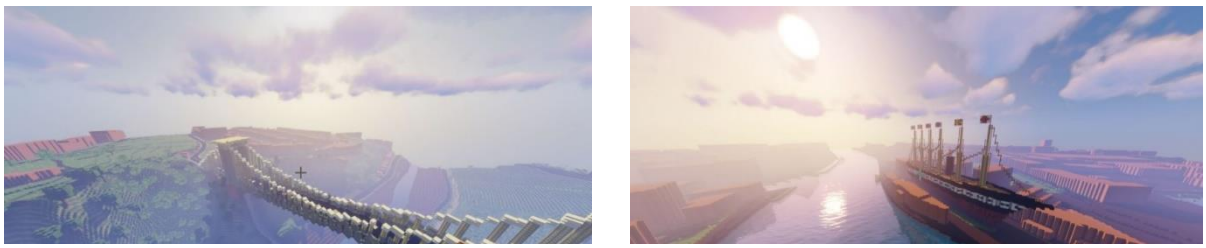

Figure 11: Stills from The West in Minecraft worlds, Clifton Suspension Bridge on the left and SS Great Britain on the right.

Temple Meads, and the Roman Baths in Bath), created by Science Hunters team member Jonathan Kim.

The accompanying educational resources take a digital, play-based approach to support children to develop their own ideas and problem-solving skills, and to engage with engineering as a creative and diverse subject that can impact the world around them. The lessons use the world as the setting for children to explore, build, re-design and re-engineer the city around them.

Since its official launch in September 2021, The West in Minecraft has been delivered to **2,948 school-aged children**, from years 3-10, either in a classroom or community setting. This represents 47 different schools, across 116 sessions delivered.

The wider reach of the West in Minecraft includes many of the events and festivals attended by the DETI Inspire team. The Minecraft worlds have been available for stall visitors to try at the Cheltenham Science Festival, the Whitehorse Soapbox, the Sustainable Transport Day, the DETI Inspire Family Fun Day, Great Science Share, among other engagements. Anecdotally, many comments from teachers suggest that the West in Minecraft resources have been what initially interested them in the DETI Inspire team.

List of schools to receive a The West in Minecraft BoxED workshop:

Alexander Hosea	Frome Vale Academy	Pensford School
All Saints Primary	Hambrook	Puritan Primary
Ashton Gate Primary School	Hans Price Academy	Redland Green School
Ashton Park School	Hareclive E-Act Academy	SGS Pegasus
Bailey's Court	Hotwells Primary	St Nicholas Chantry
Barley Close	Kings Oak Academy	Tickenham Primary
Bedminster Down School	Mary Elton School	Tyndale Primary School
Birdwell School	Merchants Academy	Watermore Primary School
Bridge Learning Campus	Minerva Primary	Westover Green
Broomhill School	Northgate Primary	Whitehall Primary
Cameley Church Primary	Oasis Bank Leaze	Widcombe Junior
Chew Valley School	Oasis Brightstowe	Willowdown Primary
Chilton Trinity	Oasis Brislington	Woolavington Primary
Christchurch Junior	Our Lady of Lourdes Catholic	Yeo Moor Primary
Cirencester College	Primary School	
Clevedon School	Patchway	
Crockerne	Pegasus	

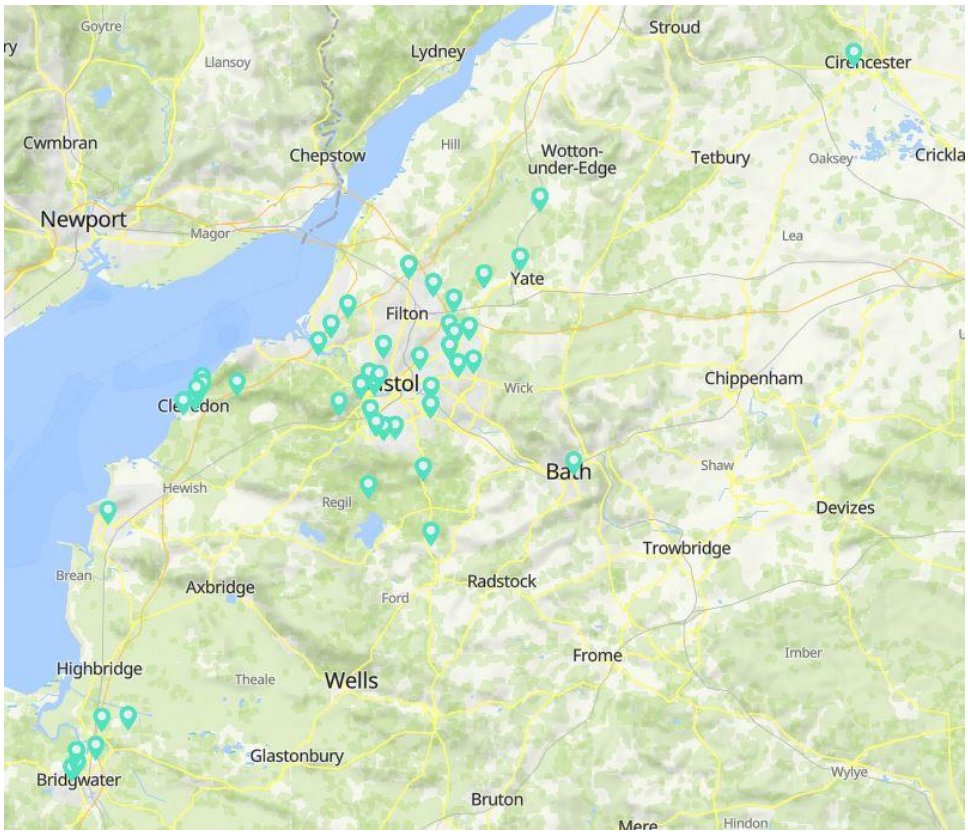

Figure 12: Location of schools and community groups who have so far taken part in The West in Minecraft.

The reaction to the West in Minecraft has been very positive. Most children have already heard of or played Minecraft, but never used a world that digitally twins reality in the way that this session allows.

"I enjoyed reflecting on the learning I had done" – Student252

"It was almost my best day ever" – Student251

"I loved that and want to do it again" – Student190

"One of the greatest lessons I have had! 100% would do it again. Thank you." – Student216

"Best lesson I've ever had! Wouldn't change a thing! Thank you to all the people that made the worlds. PS the Baths are amazingly beautiful." – Student218

Pupils found the session to be fun, exciting and interesting and this was also echoed by teachers' comments. Mark Davies of the Clevedon Learning Trust said;

"The use of Minecraft has really engaged our children in an activity they are both familiar with and enjoy. This has helped to raise their awareness, understanding and interest in engineering and the possibilities it brings. To be able to link this with a visit to the Clifton Suspension Bridge has brought engineering to life and allowed children to use the STEM achievements of our past to potentially encourage aspirations for their future."

Figure 13: The words used to describe The West in Minecraft, according to 163 8-14-year-olds

West of England Metro Mayor Dan Norris visited a session at Watermore Primary School in South Gloucestershire in September 2021 and heard from the students about their ideas for sustainably developing their area.

Figure 14: Pupils of Watermore Primary re-engineering their area in Minecraft, with a special visit from Mayor Dan Norris. Photo courtesy of WECA.

From August 2022, the team has partnered with aerospace charity AirLeague, and colleagues at Aerospace Bristol, to provide a free school trip offer to KS2 students. The trip has allowed students to experience a bespoke 'The West in Minecraft' session aiming to engage with the climate challenges facing the future of the aerospace industry. The students then use a newly designed Filton airport Minecraft world, as a design bed for sustainable future aerospace designs. Around **500 KS2 students** have received a bespoke session – with 17 sessions to 12 different schools.

Figure 15: Josh Warren from the DETI Inspire team running collaborative outreach sessions with AirLeague

4.3 WeCount Schools

Working in collaboration with EU citizen science project **WeCount**, DETI Inspire co-produced an activity for KS2, KS3 and KS4, themed around digital technologies (e.g., sensors) for urban mobility. The resources contain all the teacher needs to deliver curriculum-linked lessons, with or without a traffic sensor, covering maths, computing, science, and engineering subjects, alongside humanities subjects as well. The resources sit alongside the other themed packs on the Digital Trailblazers site.

Up to August 2022, WeCount has been delivered to seven schools, reaching over 560 children. Additionally, **10 traffic sensors** have so far been distributed among schools and community groups in the WECA region, including two STEM clubs (Baggator, Easton and The Old Library, Eastville, both in Bristol).

Schools to have received a WeCount session up to Aug'22

Shield Road Primary Chew Valley Oasis Brislington	Hambrook Summerhill Infants	Elm Park Primary Oasis Brightstowe

Both the teachers and pupils engaged so far have enjoyed their time:

"We had to count all the cars, trucks, cyclists and pedestrians and we had to see how many numbers we had, it was really fun. They showed us a machine and it was amazing to see how much intelligence could be in something so small." - Year 6 pupil, Elm Park Primary

"The workshops were interesting, engaging and fun. It was great to see the children being inspired about digital engineering and how this can be used to look after our world. Thank you so much again for running the workshops in our school." – Year 6 teacher from Elm Park Primary.

Figure 16: WeCount being delivered to Year 6 pupils at Elm Park Primary.

Thanks to the collaboration with the WeCount project, the educational resources have reached a European audience, having been shared (and translated where relevant) among schools in Dublin, Ireland and Leuven, Belgium - four of WeCount's case study cities, and advertised on the **WeCount website**. Together, we estimate this effort has led to **a further 2,000 children reached across Europe**.

DETI also developed primary, secondary, and community WeCount-themed lesson plans for the British Science Association, featured in their annual resource packs for **British Science Week** 2022, with **76,144 downloads**. A similar pack of resources has also been developed for KS3 for **The Scholar's Programme** of The Brilliant Club. The Brilliant Club is a national charity working with PhD

students to support pupils who are less

advantaged to access the most competitive universities and succeed when they get there. They currently work with **15,000 schools**, covering most of the UK.

Figure 17: Left: Cover image of postcard handed out to pupils who have so far taken part in WeCount Schools; Right: engagement with the WeCount school resources on Twitter.

4.4 Sustainability Solutions Summit

Over three days, in October 2021, DETI Inspire partnered with **I'm an Engineer** to host an online sustainability and engineering youth summit, ahead of the UN climate change summit **COP26** which took place in Glasgow November 2021. The Youth Engineering for Environmental Sustainability Summit (**YEESS**) enabled young people (aged 16-18) from the West of England region to connect with local engineers and policymakers, to explore how engineering can help tackle the Climate Emergency and discuss the interconnected solutions needed for future sustainability. Together they discussed potential solutions, using the engineering design process to guide discussion.

The summit focussed on three key themes from the Bristol Climate Action Plan to reach net zero by 2030: Transport, Energy and Waste. Through a series of videos, created by engineers and activists, and live chats, students were encouraged to visualise what future climate solutions might look like, from engineering innovation to societal change, discover what green jobs and career paths are available, and ask questions of our four West of England political leaders, Bristol Mayor Marvin Rees, Councillor Toby Savage of South Gloucestershire Council, Councillor Sarah Warren of Bath and North East Somerset Council, and West of England Mayor Dan Norris.

Figure 18: Clockwise from top left: Q&A with Bristol Mayor Marvin Rees, Day 1 of the summit; Q&A with South Gloucester Cllr Toby Savage, day 2 of the summit; Mayor Dan Norris joining Yr10 pupils from Orchard School, at We The Curious, for day 3 of the summit, to discuss the West of England Climate Action Plan; and Q&A with Mayor Dan Norris, at We The Curious, also day 3.

In total, **12 engineers engaged with 51 students from seven schools** across the West of England across the three days of the online summit. 27 students from one school actively took part across the three days of the summit. A further 20 students from Orchard School attended a physical one-day version of the summit, held at We The Curious science centre.

Table 4: Schools and colleges that participated in YEESS, and regional representation.

Schools	Region
Bradley Stoke Community School	South Gloucestershire
Bristol Cathedral school	Bristol
Mendip Studio School	Somerset
Orchard School	Bristol
St Katherine's School	Somerset
Sheldon School, Chippenham	Wiltshire
Cotham School	Bristol
Richard Huish College	Somerset

Each day students were asked questions to stimulate debate on the theme for the day. **74 answers were recorded from the 14 questions asked.**

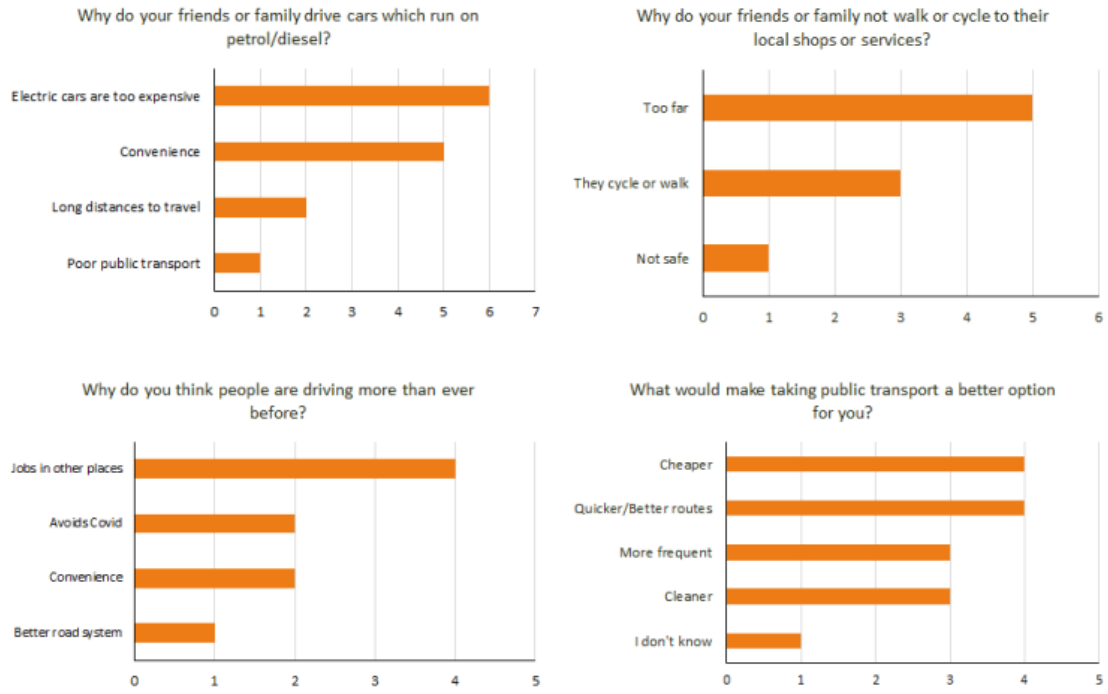

Figure 19: Answers from participating students following questions on Monday's Transport theme.

Meanwhile, **223 lines of text were submitted in the 15 live themed chats** (five for each day) and informal Coffeeshop chat.

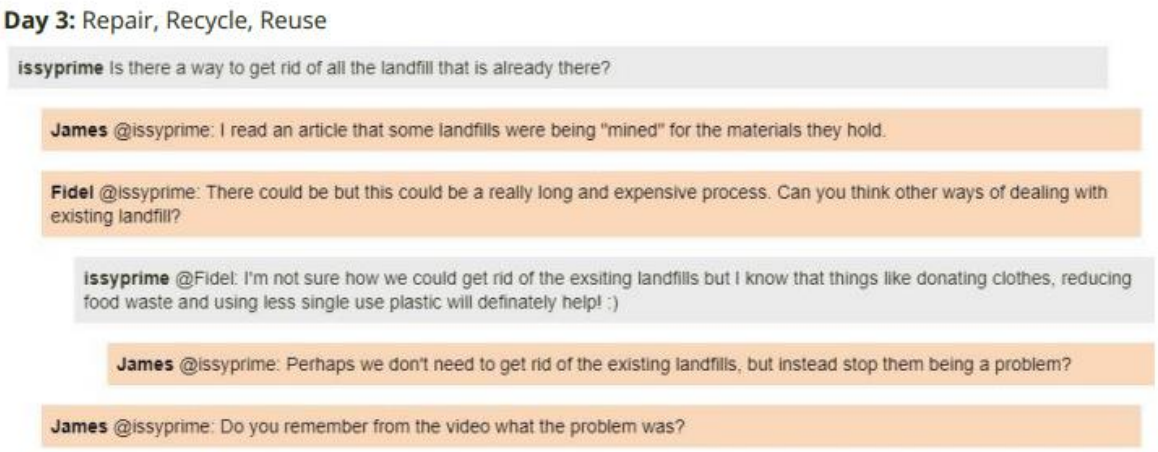

Figure 20: A snippet of the live chat from day 3, themed on waste and the need to repair, reuse, and recycle.

Many ideas were discussed across the three days, with the word cloud below highlighting the common concepts from day two of the summit.

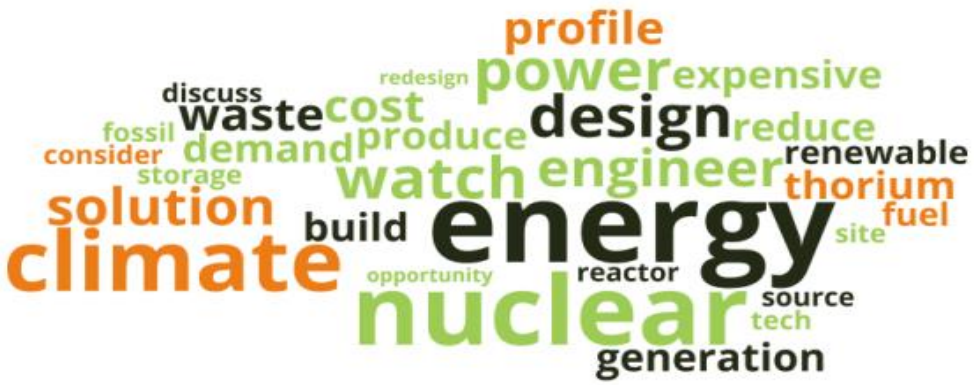

Figure 21: A word cloud depicting the topics discussed in live chats on Tuesday - all chats were themed around heating and insulating our homes.

The discussion toolkit and video resources have subsequently been turned into a Teacher Summit Resource pack, along with a Student Self-Guided Resource pack, which are available on the **Digital Trailblazer website**. The **videos** are also available to watch on DETI Inspire YouTube channel, and together have received a total of **326 views**.

The Sustainability Solutions Summit materials are being further developed as part of a new **Green Futures grant** from the West of England Combined Authority, and will be released for KS3 in 2023.

4.5 We Make Our Future / COP26

For COP26, the DETI Inspire team, in collaboration with planetarium experts **Explorer Dome**, created a new experience to celebrate the ingenuity of human engineering, address current issues around climate change, and introduce engineering as a relevant and attainable aspiration for all young

people. The show is presented and managed by the Explorer Dome science communication team, and was developed in close collaboration with the DETI Inspire team.

The new show, called 'We Make Our Future', was showcased in the Green Zone of COP26 Glasgow in November 2021 to **90 adults**. The show is presenter-led, interactive, educational and entertaining, to inspire the next generation of engineers. The experience highlights the urgent need for climate action along with the potential of green technology for economic and social progress.

Figure 22: Presenting the show in the Glasgow Science Centre Planetarium.

Figure 23: The Inspire and Explorer Dome teams at COP26 Green Zone.

Figure 24: South Gloucestershire Cllr Toby Savage had an early viewing of the new show at the Zero Carbon Bus Tour in UWE Bristol's School of Engineering building.

Inside the mobile Explorer Dome, full-dome digital projections allow audiences to visit engineering marvels from history and explore the pros and cons of technology in modern life. Design thinking offers hope to young children that humanity can solve global problems and bring about real change. Using the engineering design process, children are asked to harness their creativity to implement sustainability solutions.

Figure 25: The DETI Inspire team awed by an early viewing of We Make Our Future.

The show has been developed further through an extension grant from the **Royal Academy of Engineering**, in order to reach diverse young people and present diverse engineers working on sustainability issues. The show aims to present global climate challenges as solvable through

solution-based thinking and the Engineering Design Process, inspiring young audiences to raise aspirations, and empower them to take climate action. An estimated **1,458** young people have experienced the show, across **45 shows in 12 different schools** from years 3 through 7.

Table 5: Schools that have so far seen the Explorer Dome show, during period up to Aug'22.

Appleby Primary	Deerhurst	Horfield Primary
Ashton Gate Primary	Filton Avenue	Kings Oak
Bridge Learning Campus	Hambrook Primary	Little Stoke
Christchurch Juniors	Hareclive	Merchant's Academy

Once again, feedback has been positive, with teachers requesting that the show be repeated:

> *An absolutely brilliant show - pitched perfectly to the age group. Children were motivated to discuss/join in and ask questions… We would love to repeat this experience next academic year with the new year 7 cohort.* – Merchant Academy outreach coordinator.

5 DETI Engagement Networks

DETI Inspire brings together connections between existing networks such as Curiosity Connections and Future Quest and has developed these further through the networks available in the wider DETI consortium.

5.1 DETI Inspire Advisory Board

DETI Inspire is advised by a well-connected board of regional informal science and STEM learning institutions. Quarterly Advisory Board meetings were held online throughout 2021-2022. Board members and their organisations are listed below.

Table 6 Members of DETI Inspire's Advisory Board.

Name	Organisation
Laura Fogg-Rogers, Louisa Cockbill, Ana Bristow, Josh Warren, Lisa Brodie, Abdul Farooq, Hannah Tebbutt	UWE Bristol
Liz Lister	Graphic Science/STEM Ambassador Hub West of England
Caroline Higgins, Ellie Cripps, Joel Morley	University of Bristol
Charlotte Thomas	Ashton Gate Primary
Sara McNally, Komilla Datta	Filton Avenue Primary School
Chris Rochester	Primary Engineer
Liz Southwell	The Great Science Share
Tommy Jarvis	Bristol Learning City
Julian Welsh	We The Curious
Jane Hack	Bristol Museums
Amy Seadon	Aerospace Bristol
Rebecca Bound	Renishaw
Emily Merrison	Airbus
Magdalena Grzybek	GKN Aerospace
Karen Woodward	Engineering UK
Katy Riddington, Helen Woods	National Composites Centre
Claire Arbery	Institute of Technology
Fiona Doughton	WECA Careers Hub

5.2 DETI Inspire Digital Presence

5.2.1 Curiosity Connections network and website

The Curiosity Connections network is a collaboration between UWE Bristol and Graphic Science, connecting people and organisations wishing to promote, support and deliver inspirational STEM education in primary schools across the West of England region. In January 2021, the **Curiosity Connections website** was updated through funding from DETI, via a sub-contract with software company **Line Industries**. The updated website includes new graphics and easier functionality, allowing users to tailor the experience to suit their needs (i.e., locate information that is most relevant to them).

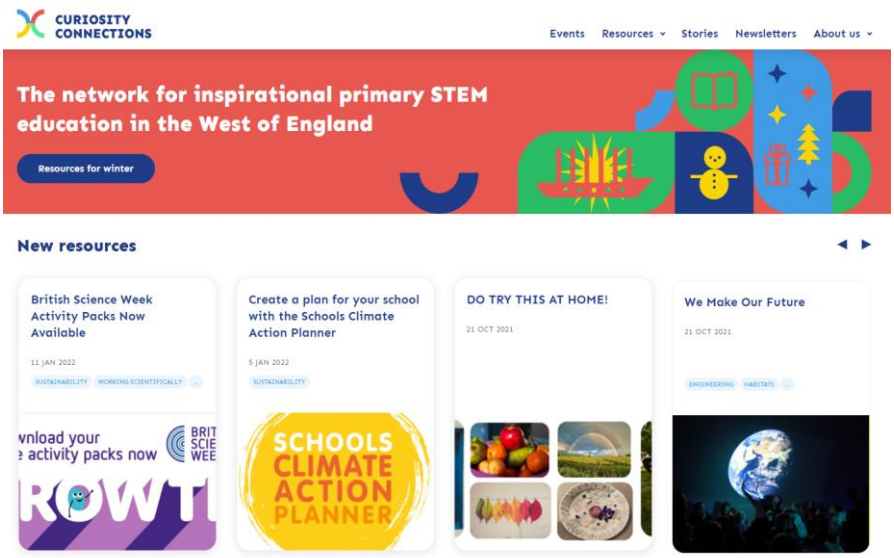

Figure 26: The new Curiosity Connections homepage, including a 'resources for Winter' feature, enabling users to quickly access resources themed for the current season.

The new website signposts to local STEM events, competitions, teaching resources and training opportunities, and serves as a place to share stories from local schools, community groups and organisations. **Newsletters are also mailed out each school half-term** (6 per year) **to 300 registered**

members and are available for download from the website. In 2021, **5 newsletters** were mailed out, with **22 new resources** added, **6 new stories shared** and **20 new events** posted on the website.

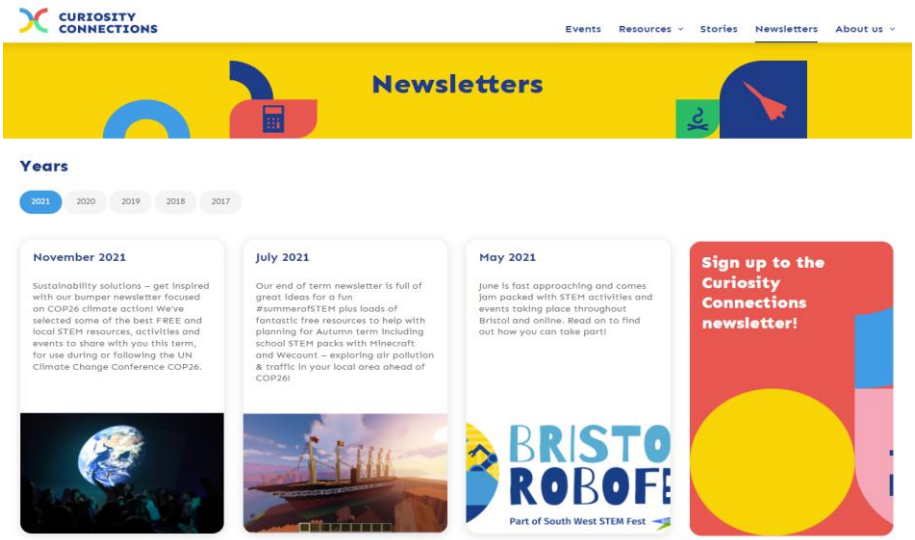

Figure 27: Newsletters are now saved in date order and can be filtered by year. They feature a short introduction and image so users can quickly find what they need.

Since the update, the website has received **11,026 visits by 5,684 visitors** (compared to 1,108 visitors in 2020). The **most popular page** visited in 2021 was the one displaying the Engineering Curiosity top trump cards, which received 2,352 visits.

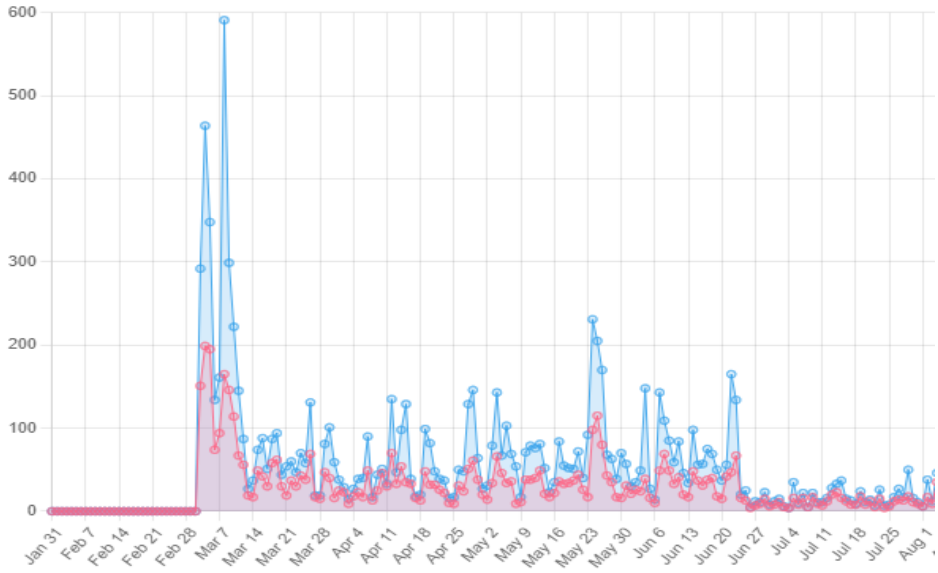

Figure 28: The number of page visits and visitors to the new website throughout the school year; there was a clear peak in March during British Science Week when new resources were promoted to schools throughout the region.

5.2.2 Social media statistics

In addition to the newsletter, DETI Inspire communicates and promotes its activities on UWE Bristol's Engineering twitter page (Engineering our Future), Curiosity Connections' twitter page and more specifically to industry partners via UWE Engineering on LinkedIn. Combined, these sites have **1,109 followers** (Engineering Our Future, 522; Curiosity Connections, 429; UWE Engineering 158). All posts mentioning @DigitalDETI are then reshared, thereby reaching wider industry audiences.

Table 6 Social media statistics from Jan 2021-Dec 2021.

	Engineering Our Future @EngOurFutureUWE	**Curiosity Connections @BrisPrimarySTEM**	**UWE Engineering LinkedIn**
Followers	522	429	158
Impressions (how many times a post is seen)	187,725	74,505	NA
New followers	112	76	NA

From January to December 2021, **both twitter platforms have gained new followers (total = 188) with posts reaching over 250,000 people (total = 262,230).**

On LinkedIn, the Engineering Curiosity cards were among the most popular posts, perhaps in part due to the large number of engineers that have a LinkedIn account. One post, tagged to International Women's Day received 45 likes and 2 comments, while another, tagged to World Engineering Day received 19 likes and 12 comments.

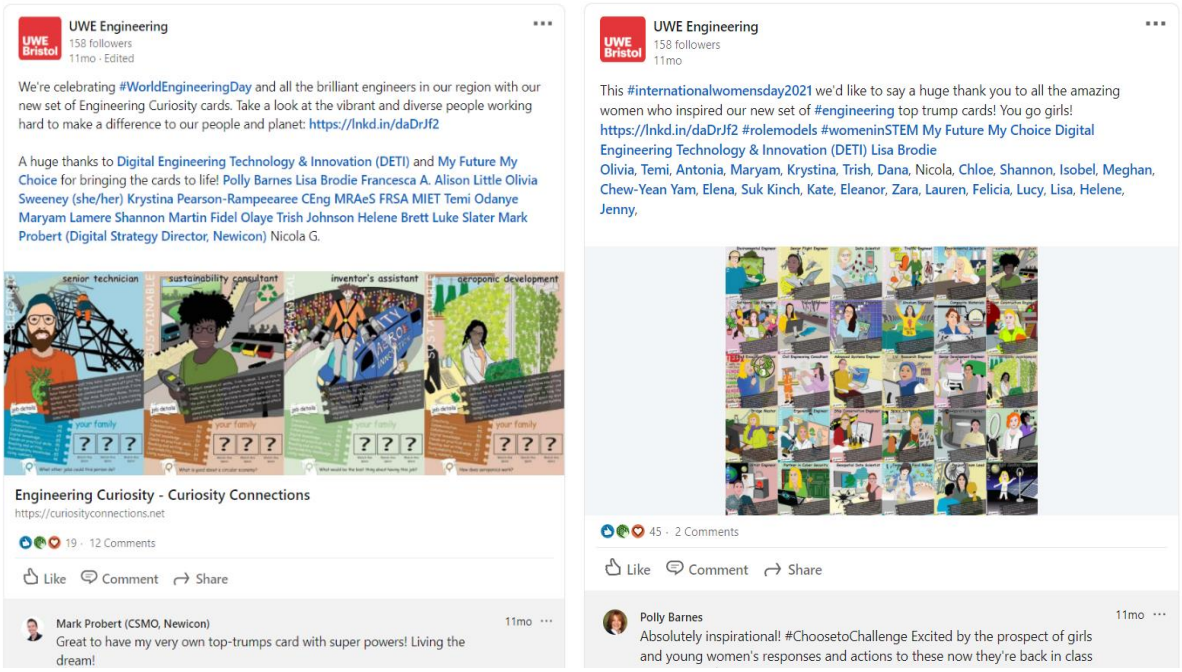

Figure 29: Two popular LinkedIn posts.

Meanwhile, it was the YEESS summit that attracted the most interest on UWE's Engineering Our Future blog, perhaps given that the posts tagged in Bristol Mayor Marvin Rees.

Figure 30: Popular posts on UWE Engineering our Future.

Lastly, as well as receiving high interactivity on their community posts, Curiosity Connections consistently receive double figures in terms of likes and retweets when it comes to announcing the publication of its quarterly newsletter.

Figure 31: Another successful post about Curiosity Connections quarterly newsletter.

5.2.3 Digital Trailblazers

Aimed at KS3 and above, **Digital Trailblazers** aims to digitally bring together the engineering community in the West of England, to showcase the past and future of STEM industries and careers. Launched in August 2021, the website features locally relevant resources, including the five activities created by the DETI Inspire team (see Section 4).

Figure 32 Advertising information for downloading the Digital Trailblazers app.

The West of England has a rich engineering heritage and is also home to businesses and organisations pioneering the latest in digital technologies. The Digital Trailblazers web app allows audiences to explore this heritage through a series of trails throughout the West of England, featuring famous engineering landmarks, businesses, and institutions. With the aid of the in-built map, users can follow the trail digitally or on foot, clicking on icons to reveal information quickly and easily. The app can also be downloaded for use when on location.

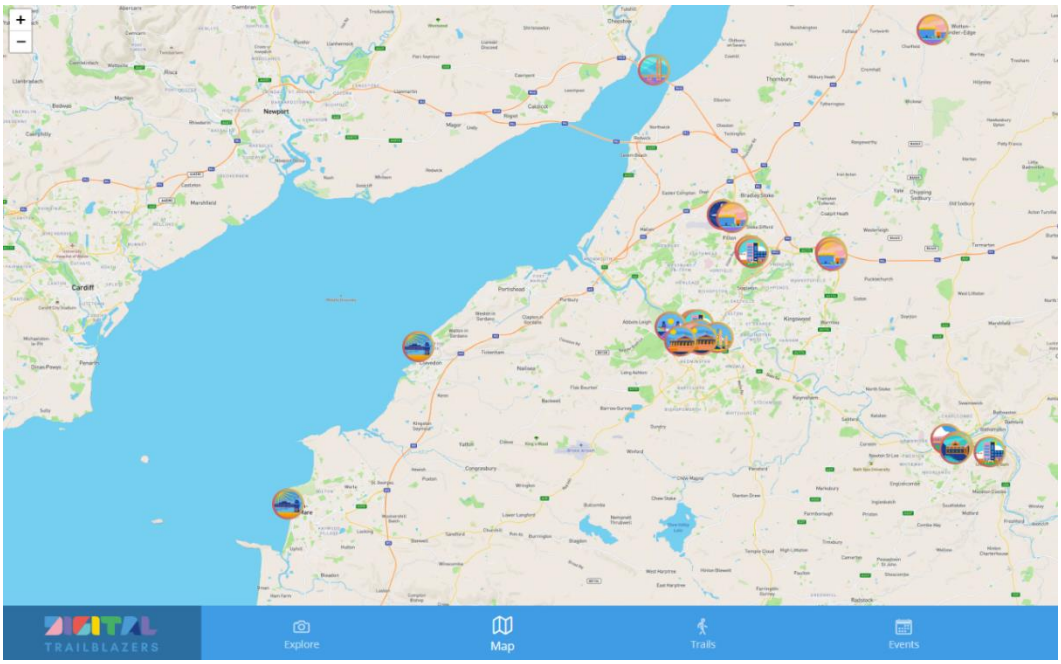

Figure 33: Digital Trailblazers map of the West of England with engineering landmarks highlighted.

5.3 DETI Inspire Partner Programmes

5.3.1 Industry Engagement

The DETI Inspire team has worked with various industry partners over the past two years. One such event was the launch of **GKN Aerospace's Global Technology Centre** in October 2021. The DETI Inspire team were invited to talk about the sessions and outreach developed, with stakeholders and aerospace industry partners. UWE EDM Head of Department Dr Lisa Brodie was also part of a Q&A panel at the event, fielding questions from the attendees about the importance of developing the skills of employees and the role the university and the DETI Inspire team has in engaging with future engineers.

The team also showcased resources and developments came at **the opening event** of the School of Engineering building on the UWE Frenchay Campus on 18th November 2021. **The event was attended by nearly 100 representatives of the local engineering industry**, as well as many of the collaborators, STEM Ambassadors and engineers that the team has directly worked with. Invited to speak at the event was Dawn Bonfield MBE, founder of Towards Vision and Magnificent Women, and Deputy Chair of the Women in Engineering Committee, among other accolades.

5.3.2 Big Beam In

DETI Inspire hosted a series of online engineering engagement events as part of British Science Week celebrations in March 2021 (5-14th March). Due to Covid19 lockdown restrictions, all activities were conducted online, leading to the idea that the engineers were 'beaming' into the children's classrooms.

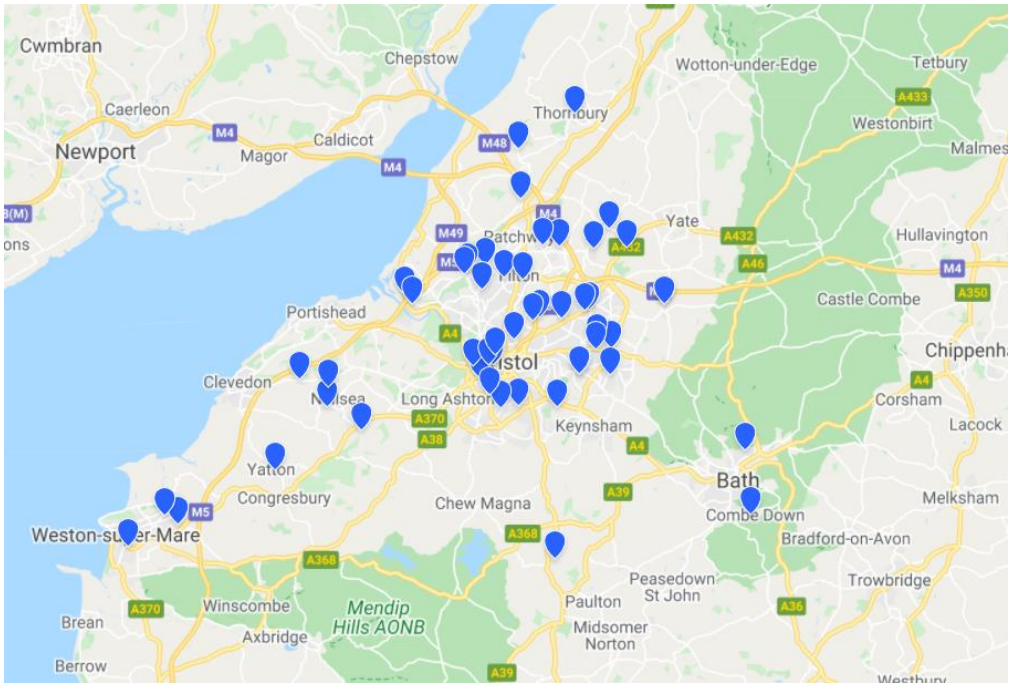

Figure 34: Map showing the locations of schools engaged with the Big Beam In.

The Big Beam In connected **54 primary and secondary schools** from across the region with **15 local engineering ambassadors**, providing an opportunity to engage over **3,500 pupils** with engineering careers in the West of England. The activities were centred around the lesson plans developed to accompany the Engineering Curiosity cards.

A key theme for the sessions was challenging common stereotypes and myths about engineering, and this was achieved through live interactions with real-life local engineers, a new set of curriculum-linked teaching resources and the Engineering Curiosity card set with accompanying TikTok-style videos.

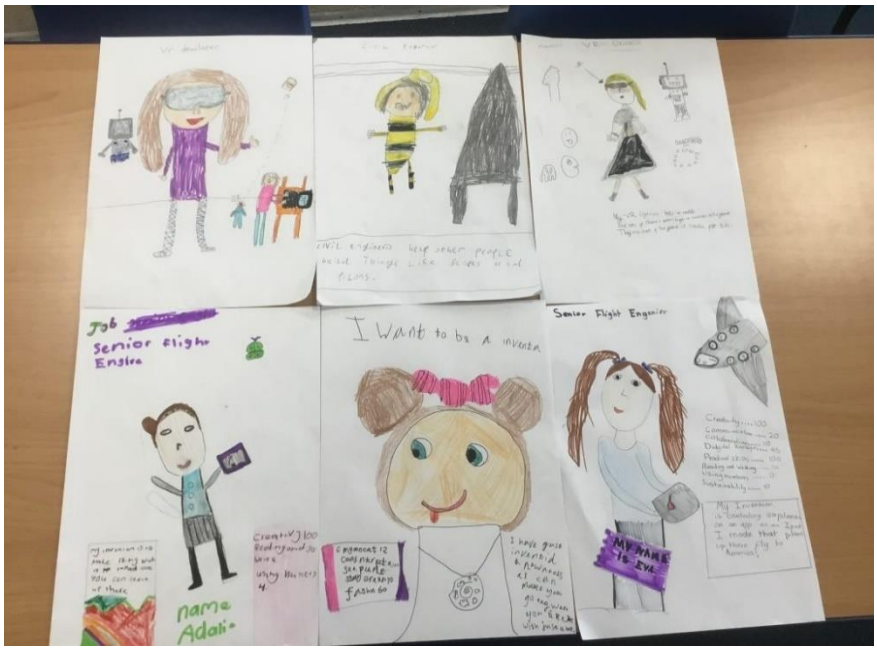

Figure 35: Future Engineers, inspired by the Engineering Curiosity card set and teaching resources during the Big Beam In event.

The event proved popular with teachers and feedback suggested the online format worked well during this time of uncertainty.

> *"Thank you so much for joining us for our assembly on Friday. The children got a lot out of it. It's been very tricky co-ordinating Science Week this year with us not knowing whether we would be open, but it was good to have had something planned from the outset!"* - Lucy, Year 3 Teacher and Science Lead at Ilminster Avenue E-ACT Academy

> *"Our engineer (James) was excellent. The children were really interested to hear about the projects he has worked on and what his role as an engineer is. They were able to ask him lots of questions and were inspired to design their own inventions after the session!"* – Becky, Teacher at Cathedral Primary School Bristol

Feedback from the engineering ambassadors was also very positive.

> *"I enjoyed taking part. I've done some STEM events before but up until now I've never had the time to present to schools during the day. The virtual format made that possible this time. As much as I dislike lockdown, it does have its silver linings!"* - Adam, Acoustic Engineer

5.3.3 Building to Break Barriers

Building to Break Barriers is funded by the **Royal Academy of Engineering** through the Ingenious Awards scheme and is part of the **Science Hunters** collaboration between UWE Bristol and Lancaster University. Science Hunters has been using Minecraft to engage children, particularly those who may face barriers to accessing educational opportunities, with STEM since 2014 via various funding streams with highly successful results. **Building to Break Barriers** was initiated in April 2020 to develop Minecraft-based engineering outreach activities for children in under-represented groups, support engineers in developing engagement skills and deliver activities to Minecraft Clubs and schools. In September 2020, the project officially collaborated with DETI Inspire to partner on developing and delivering the West in Minecraft activity specifically, following the successful Science Hunters approach. See The West in Minecraft section for more information.

Outside of this collaboration, Building to Break Barriers is currently developing resources and delivering sessions to Minecraft Clubs for children with Special Educational Needs (see **Hobbs et al. 2020**) and Looked After Children, and community and school sessions for children falling within groups under-represented in engineering, across the UK. The project has encouraged participating engineers in the South West to sign up to the Diversity Demonstrator and supported those also participating in Women Like Me via opportunities to contribute to developing resources, undertake engagement activities and develop outreach experience.

School visits reached approximately **400 children** with further visits planned nationally. Schools span the South West, Midlands and North West of England. Virtual Minecraft Clubs have been operational since 2020 and have resulted in more than 100 engagements in the North West and Midlands regions across three clubs (these sessions build on successful long-running Science Hunters provision for children with Special Educational Needs and Looked After Children and are deliberately kept to small groups, see **Hobbs et al. 2020**). Engineers engaged with the Diversity Demonstrator have contributed to the work needed to provide these sessions.

5.3.4 Like To Be

DETI Inspire collaborated with **Like To Be** to host an online digital engineering careers event during the week of Bristol Technology Festival, from the 9th-15th November 2020. LikeToBe is an online Career Event Network Platform, which helps introduce students to professional online networking and creates regular, employer engagements on the platform. It was designed to connect students in geographically isolated and socially disadvantaged areas with employers and organisations to provide opportunities for all, regardless of their location or background.

The digital engineering careers event enabled young people to hear from inspirational engineers who are designing and creating innovative new solutions to real-world problems. Speakers from a diverse range of engineering fields and specialisms were available to answer questions during the event, with a selection available to answer questions in real-time.

14 engineers submitted video content, all of which were 'liked' by the students several times and 9 questions were posted on the engineer's profile pages. The event webpages received **583 views**. The videos and webpage content remained on the LikeToBe web portal for the whole of the 2020/21 academic year so students could continue to use the free online resource.

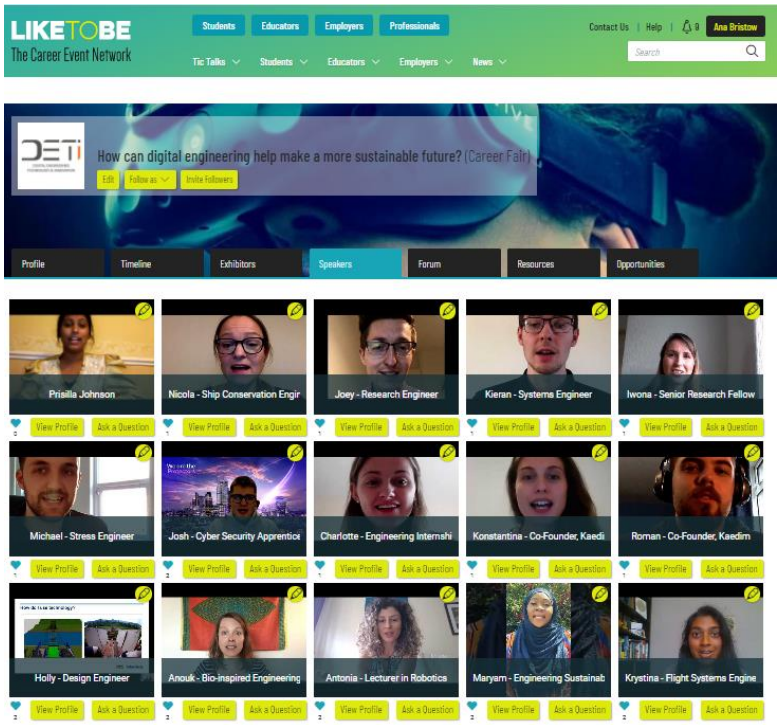

Figure 36: LikeToBe web portal

5.3.5 STEM in the Community

With the help of a grant from the UWE Community Fund, in 2021 DETI Inspire worked with the STEM Ambassador Hub West England to establish 3 community STEM clubs in 3 different areas of Bristol. Lawrence Weston Club ran as a 6-week series of STEM activities delivered as part of the after-school drop-in youth provision on Thursday afternoons during May and June 2021, in collaboration with Oasis Community Trust and Ambition Lawrence Weston. This activity attracted up to **20 young people a week** to take part in The West in Minecraft challenges delivered by DETI Inspire team and supported by STEM Ambassadors, with related physical STEM activities taking place alongside.

A club in Easton was set up and run by STEM Ambassadors in collaboration with community group Baggator. It started in May 2021 and has run continuously on a Monday evening (37 weeks to date), transforming into the Easton Data Garden to support community-wide participation in air quality data projects. **A regular crowd of 10 young people** come every week, together with parents, friends and other family, to take part in a mix of physical STEM activities and tech-based activities making use of Minecraft and other digital tools.

Figure 37: An image from a tweet promoting the Easton Data Garden.

The Eastville club was set up by STEM Ambassadors and since September 2021 has run in partnership with The Old Library and with support from the DETI Inspire team on Thursday afternoons during term time (18 weeks so far). The club regularly attracts up to **50 young people and their parents / carers** to take part in Minecraft activities, robotics and Lego challenges.

Figure 38: Old Library Minecraft session.

Participants at these community STEM clubs tend to be around KS2 age, with fewer, older (KS3 and KS4) young people acting as volunteer helpers and supporters. The ethos of each of these clubs is to expose more young people to STEM and enable them to benefit from the science capital resources the city has to offer which, because of where they live, the young people who attend might not otherwise benefit from.

Table 7 Total engagements and possible reach of STEM Clubs.

	Lawrence Weston	Easton	Eastville
Total engagements	6	37	18
Possible reach	120	10	50

5.3.6 Bristol Robotics Festival

A collaboration between DETI Inspire, Bristol Robotics Laboratory (BRL) and the University of Bristol's Digimakers, with support from the West of England STEM Ambassador hub developed a new festival to celebrate robotics in the city. **Bristol Robofest** launched in June 2021 as a city-wide initiative to celebrate the UK Festival of Robotics and raise the profile of STEM in our local communities.

During the festival, robots popped up in five locations throughout the city, with **over 130 children and family members** taking part in a variety of robot themed activities in person, with many more accessing online activities (numbers unknown). UWE Bristol featured the event on its **Engineering blog**. An additional **638 people** signed up to the BRL's conference, tuning into talks from **50 engineers**.

Table 8 Engagements as part of Bristol Robotics Festival

In-person events	Online activities
Family fun day, at the Old Library, Eastville **Open City Lab,** at We The Curious **Robotics activities**, at STEM@Baggator Community STEM Club **Robotics activities,** at Lawrence Weston Community STEM Club **University of Bristol's Digimakers robotics and coding workshops,** at Barton Hill Settlement	**We Make Our Future,** science show with Explorer Dome Bristol **Robot treasure hunt,** game created by FARSCOPE students **Mosaix with swarm robot tiles,** remote control of swarm robots to create a communal art piece **Pepper the Robot Goes to School with Autistic Children,** A talk by Severin Lemere and researchers from UWE Bristol **Bristol Robotics Lab (BRL) Conference**: various talks delivered by staff and MSc students from the BRL

Figure 39: Pepper the robot joined in the fun at the Old Library robot family day.

Figure 40: Left to right: Children exploring how a Thymio robot follows a drawn track, at the Digimakers workshops at Barton Hill Settlement; Children exploring the many different personalities of Thymio robots at STEM @ Baggator, community STEM Club in Easton

5.3.7 South West STEM Fest

South West STEM Fest (SWSF) was a virtual STEM Festival, held between 7th- 25th June 2021. It was a collaboration between the STEM Ambassador Hubs West England and South West Peninsula. It consisted of a programme of online talks, demos and tours suitable for primary, secondary, FE and home educators that showcased the best of STEM in SW England. The corporate sponsors were Babcock, Software Solved, and Weston College.

Over the course of the 3 weeks, SWSF delivered **59 live and pre-recorded events** and **reached over 5,500 children and young people across all sectors**. Events involved **73 different companies** and were fronted by a mix of professional presenters alongside 68 STEM Ambassadors in everything from Archaeology to Aerospace. **Approximately 48 (66%) of the Ambassadors came from an Engineering profession.**

Figure 41: Selection of headers from South West STEM Fest

5.3.8 Routes Into STEM Panel

In February 2021, DETI Inspire was invited to host an online webinar, in collaboration with the Engineering Development Trust (EDT)'s **Routes into STEM programme.** The webinar took the form of a live question and answer session between Year 9 and 10 students and a panel of engineers, all of whom featured on the Engineering Curiosity cards. The panel took live questions from the audience of students, talking about their roles, their routes into the position, and advice for those wishing to take engineering forward.

Forming the panel was:

- Temi Odanye - Mechanical Design Engineer, LettUs Grow
- Richard Moorcraft - Technical Design Engineer, Smurfitt Kappa
- Olivia Sweeney - Sustainable Waste Consultant, Resource Futures
- Laura Star - Naval Architect, BMT

The **webinar** was attended by **over 200 Year 9 and 10 pupils from across the country**, and over 100 questions were sent into the live chat during the session. Two subsequent webinars were also held in collaboration with EDT Routes into STEM, focussing on Higher Education routes and choices for engineering. The UWE School of Engineering was represented by Dr Pritesh Narayan, Deputy Head for the Department of Engineering Design and Mathematics (EDM).

5.3.9 Primary Engineer

Primary Engineer is a national organisation that brings engineering into the classroom, inspiring children, pupils, teachers, parents, and engineers. In the South West, UWE Bristol is the academic supporter of their programmes.

In 2021 DETI Inspire supported online teacher continuing professional development (CPD) training sessions to **11 teachers from the 10 schools** in the West of England region. These one-day online sessions supported teachers to deliver the Electronics Module from Primary Engineer, which enables a whole class to take part in a curriculum-mapped engineering project, in this instance, building an electric car. The sessions took place online, due to Covid19 restrictions.
Feedback was gathered from teachers that participated, to evaluate their before and after confidence in teaching engineering-related subjects, as well as perceived impact of the lesson on their class(es).

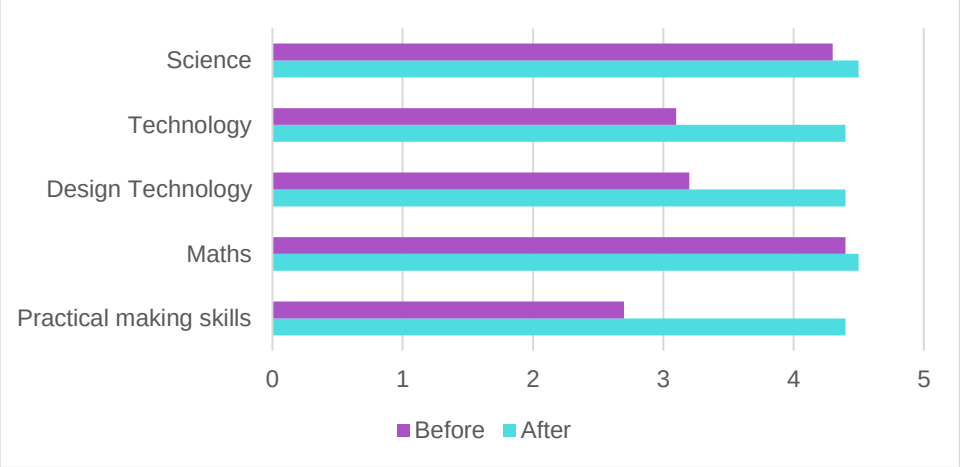

Figure 42: Teachers' confidence in engineering skills before and after training.

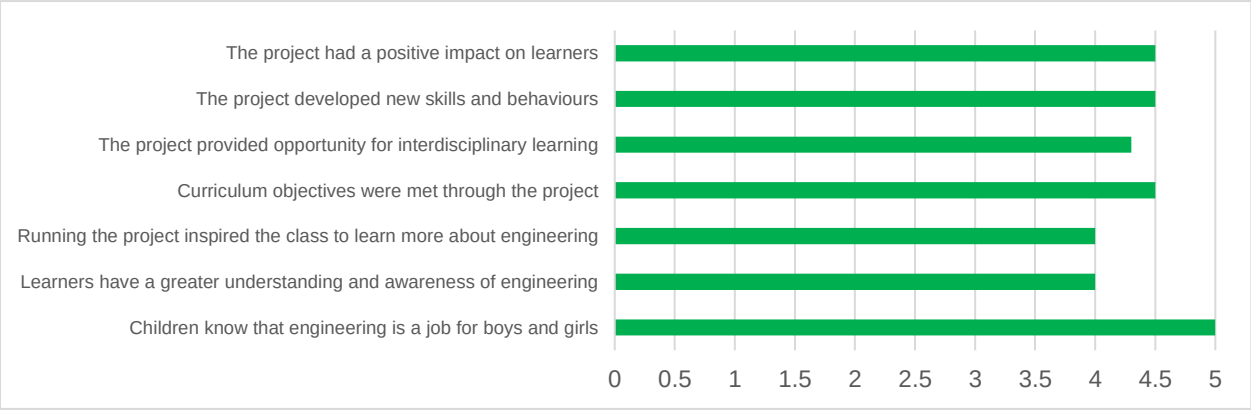

Figure 43: Perceived impact of Electronics Module on learners, according to teachers.

5.3.10 The Leaders Award Programme

UWE Bristol are the academic supporters of Primary Engineer's **Leaders Award programme**. The programme challenges children, aged 3 to 19, with the question - "If you were an engineer, what would you do?"

Children submit detailed designs for inventions to solve real-world problems, following interactions with engineers from the West of England. This includes online interviews to inspire children, grading competition entries and finally a team of UWE student engineers pick one of the winning designs to build into a reality.

Figure 44: 2018/19 winner, student Philippa Griffiths from Hugh Sexey CE Middle School, with the prototype of her Red Line Braking System design.

The competition is promoted to children through the Curiosity Connections network and UWE Bristol hosts the grading days and Exhibition Day - where category winners are displayed, and awards presented to the children by local VIPs. Online virtual galleries were used to showcase children's designs in **2020** and **2021**.

In early 2021 a team of student engineers from UWE Bristol selected one of the winning designs from the 19/20 South-West Leaders Award to build. The team selected the solar electric heated blanket idea that Mary, a local Year 5 pupil, designed to provide warmth for the homeless.

The team designed a product that met the needs of the end-user i.e. a durable, portable outdoor blanket that could be produced at low cost and would be easy to maintain, hygienic and able to provide heat for an appropriate length of time. Using electronic simulations, schematic diagrams and 3D models, the students built a model for testing and analysis, which would successfully fulfil these requirements.

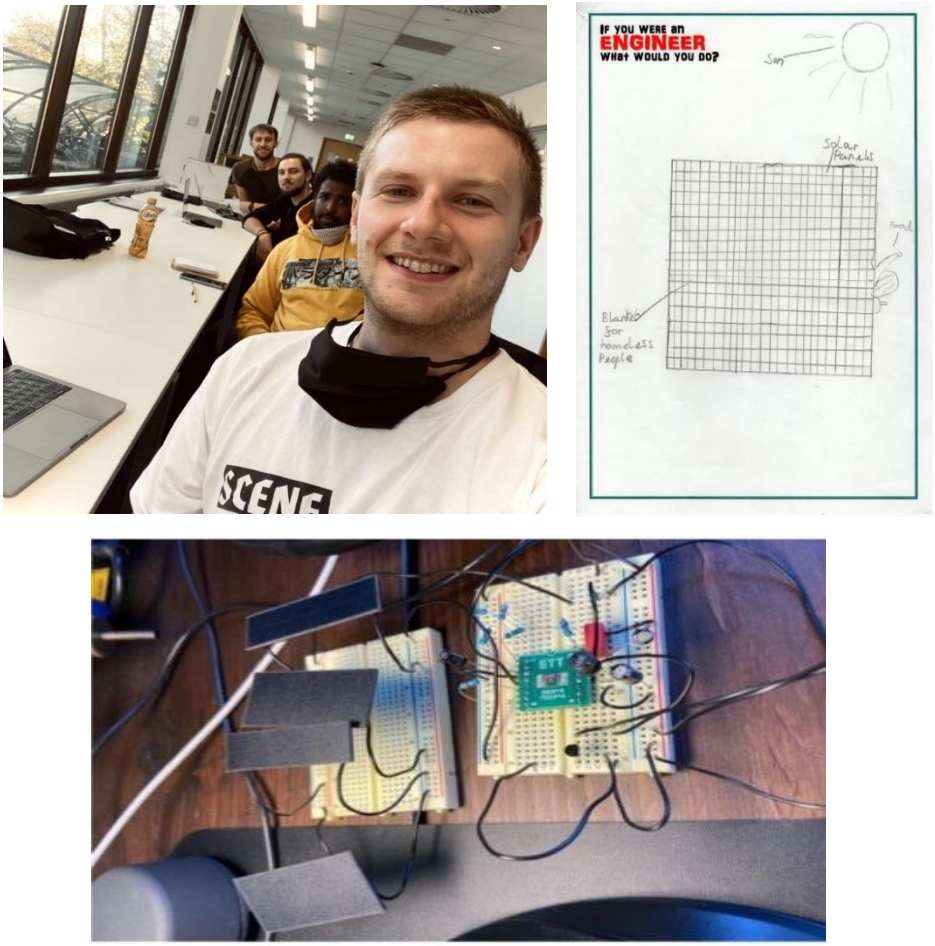

Figure 45: Clockwise from top left: The team of UWE Masters students tasked with building a functional prototype of the blanket include student electronic engineers Oliver Németh, Eimantas Medziunas and Kieran Easdale, and student mechanical engineer Ahmed Nor; Mary's original solar blanket design; the prototype used for testing and analysis.

The Awards Ceremony returned in person on Friday 24th June 2022, with UWE Engineering hosting the showcase and awards ceremony for the Leaders Award competition – celebrating young people's inventions designed to solve the world's problems. Members of the DETI Inspire team, along with other industry partners and ambassadors from the region, formed the judging panel for the competition. Choosing inspiring and ingenious designs from young engineers and inviting them to the School of Engineering for an awards ceremony.

At the event, West of England Metro Mayor Dan Norris spent time hearing about the designs and meeting the 12 winners. He opened the official awards ceremony, before handing over to UK Director of Primary Engineer Chris Rochester and Head of CATE College Professor Elena Marco for the presentations. The winning engineering designs were displayed, and then formed part of the event space for the DETI Inspire Family Fun Day. On Saturday 25th June 2022, the Inspire team invited local families to the School of Engineering building to experience a range of free science and engineering activities.

Figure 46: The winners of the Leaders Award with the organising team

The families that came to the event explored different aspects of engineering such as coding and robotics through LEGO Mindstorms and Pepper the humanoid robot, engaged with our The West in Minecraft session, designing the best wind turbine blade and competing to generate the most energy, and other stations featuring, eco-houses, crafting and a free showing of the We Make Our Future planetarium show from Explorer Dome.

Gauging from ticket reservations and the footfall at each activity station, we estimate there to have been around 300 young people join us for the day. In addition, each child was accompanied by at least one parent or carer who also provided much positive feedback about the day.

5.3.11 Great Science Share

The Great Science Share is an annual campaign to inspire 5-14-year-olds to share their scientific questions with new audiences, culminating in a celebration event in June each year. Historically, UWE Bristol's School of Engineering would host a celebration event for schools in the region, bringing teachers and pupils together to share their scientific discoveries. In 2019, nine local schools and home education groups visited Frenchay Campus for such an event.

Due to Covid restrictions it was not possible to host physical events in 2020 or 2021, but an online event was organised by the DETI Inspire team in June 2021 for local schools who had participated in the GSS during the pandemic. **204 pupils from 2 local schools** joined the team for their first ever online viewing of the new sustainability solutions science show, We Make Our Future, delivered by Explorer Dome via Zoom.

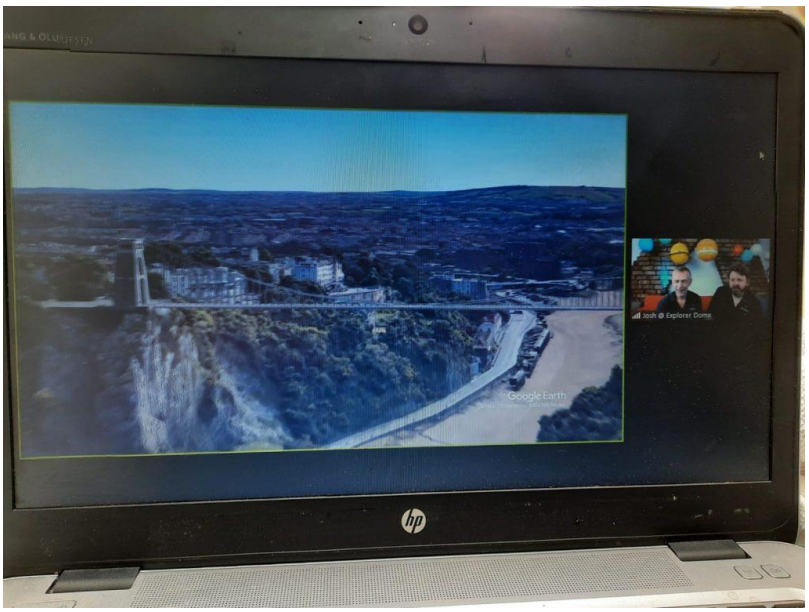

Figure 41 Flying over some of Bristol's famous engineering landmarks – the virtual show via Zoom

5.3.12 Curious Stories for Curious Children

'Curious Stories for Curious Children' first launched in 2019 as part of Bristol's Storytale Festival with STEM Ambassadors deployed to libraries and historically-scientific relevant locations across Bristol, to read short, stereotype-busting children's stories. The 11 events took place in October half-term 2019 with nearly 300 children and adults attending.

Figure 42 STEM Ambassador reads to children at Wick Road Library in October 2019.

In preparation for the original events, a **Stereotype challenging booklist** - to change perceptions of what science is and who scientists are, was collated. A library of these books has been expanded at UWE Bristol in 2021.

In collaboration with the West of England STEM Ambassador Hub, DETI Inspire re-launched Curious Stories for Curious Children in schools in 2022. STEM Ambassadors underwent training with UWE Bristol's Associate Professor Jane Carter, who specialises in promoting reading with young children, before going into schools in the South West to read stories supplied by UWE's STEM stereotype-busting library.

5.3.13 Woodsprings Wings and Soapbox events

During summer 2022, the DETI Inspire team were invited to attend two events, the White Horse Soapbox Derby, and the Woodsprings Wings festival (May 21st and July 9th/10th respectively). For the Soapbox Derby, the team brought the range of activities such as The West in Minecraft, the Engineering Curiosity cards, the LEGO Mindstorm robots, Thymios and WeCount, and displayed them on an interactive stall as part of the STEM event. The Soapbox Derby event was very well attended, and saw teams compete to build a soapbox car and race down a track.

Around **250 young people** were engaged throughout the day. DETI Inspire student ambassadors were also invited to support an interactive activity at the Woodsprings Wings Aircraft festival, where young audience members made and built model aircraft. Aiming to inspire and engage with hands-on aerospace engineering.

5.3.14 Cheltenham Science Festival 2022

Running from the 7th to the 12th of June 2022, the DETI Inspire team hosted an engagement space at the Cheltenham Science Festival in partnership with the IMechE (Institute of Mechanical Engineers). The team formed a part of the 'Discover Zone', the space within the festival for interactive exhibits and engagements from a range of industry partners and STEM providers. Among the engagements and activities brought to the Discover Zone by the team; were 'The West in Minecraft' worlds, 'Engineering Curiosity' cards, LEGO Mindstorms robot building kits, line follower robots, sumo-fighting robots, the 'Manhattan' musical coding programme (through UWE colleague Chris Nash), and Thymio robots. Over the course of the festival, based on figures and estimations provided by the Cheltenham Science Festival team; the DETI Inspire team is thought to have directly engaged **6,400 young people** moving through the Discover Zone, from **80 schools.**

Figure 49 and Table 9: The interactive stall at the Cheltenham Science Festival with schools attending

Airthrie School
Alderman Knight School
Andoversford Primary School
Balcarras School
Belmont School
Berkhampstead School
Bredon School
Cheltenham Bournside School
Cheltenham College Prep School
Chosen Hill School
Christ Church Primary School
Dean Close Prep School
Dene Magna School
Denmark Road High School
Elmfield School for Deaf Children
Field Court Junior School
Gardners Lane Primary School
Gloucester Road Primary School
Gotherington Primary School
Grangefield School
Highworth Warneford School
Holy Apostles Primary School
Isbourne Valley School
King's School, Gloucester
Lakefield Primary School
Longborough Primary School
Naunton Park Primary School
Pate's Grammar School
Powells Primary School
Randwick Primary School
Ribston Hall High School
Rodmarton School
St Joseph's RC Primary School
St Thomas More Catholic Primary School
Sedgeberrow First School
Sir William Romney's School
Stroud High School
Temple Guiting School
Tewkesbury School
The Catholic School of St Gregory the Great
The Cotswold School
The Downs School, Malvern
Woodmancote School

6 Inspire Sustainability

All five of DETI Inspire's outreach activities are showcased visually below and continue to be available to download for free from DETI's website.

Figure 50: The outreach sessions available for schools and community groups

DETI DIGITAL ENGINEERING TECHNOLOGY & INNOVATION
WEST OF ENGLAND Combined Authority
STEM AMBASSADOR HUB STEM Ambassador Hub West England
UWE Bristol University of the West of England