

EXPLORE YOUR UNIVERSE

ATOMS TO ASTROPHYSICS



Explore Your Universe

Phase 3

Final Report

March 31st 2018

UK Association for
**Science and
Discovery Centres**

The logo for the UK Association for Science and Discovery Centres consists of a cluster of colored circles in shades of green, yellow, and blue, arranged in a roughly circular pattern.

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Executive summary

Explore Your Universe is a successful national STEM programme which brings together some of the most fascinating and diverse cutting-edge science in the country with the talents and infrastructure of the nation's largest network of dedicated science engagement organisations.

Explore Your Universe Phase 1 began in 2012 and ran for two years and reached 156,880 people in ten regions across the UK. For Phase 2, ASDC trained an additional ten centres to run the programme and increased the reach to 341,714 people.

The vision of the programme is to inspire a new sense of excitement amongst young people around the physical sciences by sharing the amazing stories and technologies of STFC. To achieve this, the Explore Your Universe team has created an exceptional set of hands-on activities, experiments, schools workshops, public shows, meet-the-expert sessions, a website, a full training programme and handbook, and a variety of other resources to share the inspirational science of STFC.

This report focuses on Phase 3 which aimed to increase the value-for-money, sustainability and legacy of the Explore Your Universe Programme, further extending the reach into disadvantaged and underserved schools and communities to engage those who are remote from STEM. This latest phase has reached 39,273 children and adults, largely from underserved communities, in 14 regions of the UK and across England, Wales, Scotland and Northern Ireland. The Phase 3 partners have considerably exceeded their combined original target of reaching 15,000 people.

Together the three phases of Explore Your Universe have engaged a total of 380,987 children and adults in 23 regions of the UK with cutting-edge physics and engineering. In addition to this number are all the wider activities, schools workshops and events that are running at science centres and universities across the UK using the equipment, activities and resources created by ASDC for Explore Your Universe. Added to this is the impact created by the scientists we have trained over the years and who have become invigorated in engaging the public with their research through taking part in Explore Your Universe.

Fourteen science centre partners were selected to take part in Phase 3 and each was awarded a grant of £3,000. Each science centre undertook a variety of programmes to reach widely, including community events, outreach to rural and underserved schools, activities and workshops at a Prison, bursary schemes for schools to cover coaches and other costs to visit a centre for high-end physics workshops, and careers events involving local and national employers.

An additional science centre partner was added to the programme in this phase, Techniquet Glyndŵr, giving the programme a strong reach into rural and underserved areas of North Wales.

In this phase, ASDC have also redeveloped the Explore Your Universe website www.exploreyouruniverse.org including experiments to try at home and scientist profiles showcasing researchers from STFC facilities. ASDC provide support to all the centres including science updates via the EYU newsletter showcasing the latest STFC science stories and news.

The independent academic evaluation of Phase 3 of Explore Your Universe was undertaken by Professor Justin Dillon at The University of Bristol and an overview of findings has been presented within this report and in the full independent report.

The evaluation draws on response from 213 teachers and 4,282 students. Feedback from both students and teachers was overwhelmingly positive:

- 98% of the 129 teachers surveyed report that they would recommend the activities to colleagues.
- 91% of students from schools in areas of higher deprivation were very positive about the activities (and 88% of students from schools in areas of less deprivation).
- 89% of the students whose schools had received bursaries rated the EYU activities as 'Very Good' or 'Good'. Primary school students (92%) were more positive than secondary school students (87%).
- Boys and girls were equally positive about the activities with some slight differences for some aspects.
- 87% of primary school students felt inspired by the activities
- Three-quarters of students said that they would tell friends and family about the activities with female students being more positive, especially those from primary schools.
- Almost 80% said they found the activities inspiring.
- Significant numbers of students reported that they were more likely to consider a career in STEM after taking part.
- 77% of teachers reported that they would talk with their students about the EYU content in the future. Two-thirds of the teachers reported that they were interested in attending CPD on this topic.

Explore Your Universe Phase 3 follows on from the enormous success of Phase 1 and 2 and 380,987 children and adults have now taken part in bespoke Explore Your Universe schools workshops, family shows and activities.

However, the legacy and impact of Explore Your Universe is substantially wider and more powerful than this. Overall the programme has pioneered a step change in the way the science engagement community across the UK deals with the latest research in physics and engineering. It has enhanced the skillset nationally of science engagement professionals enabling them to bring the stories and science alive with families and schools across the UK.

This has made a significant change nationally and the impacts will be felt for many years to come. This is specifically because the programme has given the UK an army of science engagement professionals trained and confident in the latest research in the physical sciences who now have excellent kit, hands on resources and experiments to use with a range of audiences into the future.

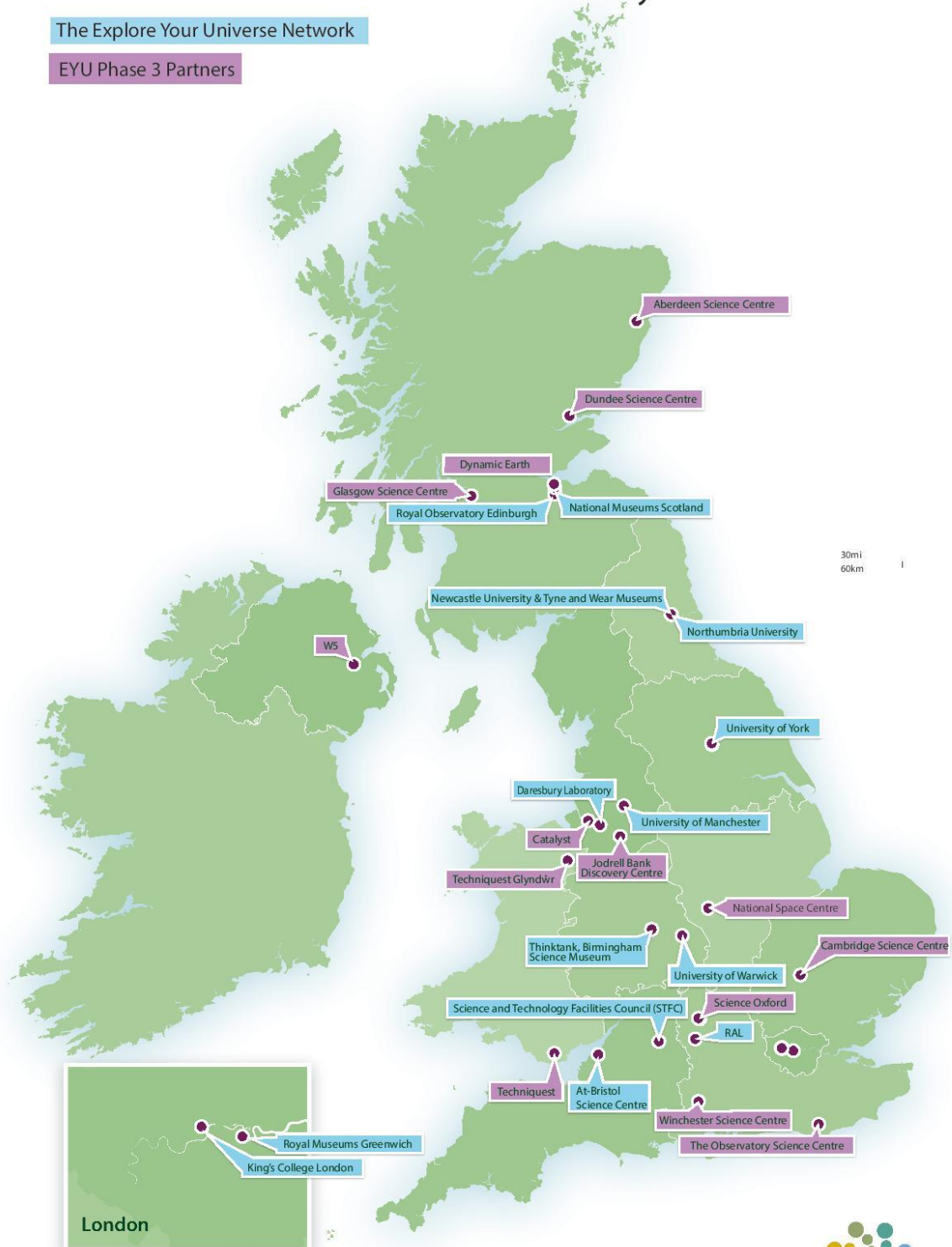
Clearly from the evaluation, there is also a huge impact on the teachers across the programme, who once inspired will continue to bring great exciting science to students for many years to come. We would also like to hope that we have enhanced the lives of many of these families who have shared this learning together, and hope that the young people will go on to have a life time interest in these fascinating topics, innovating along the way.

Explore Your Universe Phase 1, 2 and 3 Partner Map

The Association for Science and Discovery Centres Network

The Explore Your Universe Network

EYU Phase 3 Partners



www.sciencecentres.org.uk

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Programme Overview

The Association for Science and Discovery Centres

The Association for Science and Discovery Centres (ASDC) brings together the UK's major science engagement organisations to play a strategic role in the nation's engagement with science. Within our membership are over 60 of the nation's largest publically accessible science centres, discovery centres, science museums and scientific bodies. Together our vision is for a society where people of all backgrounds and in all parts of the UK are inspired and fully involved with the sciences.

Every year in the UK, 20 million people of all ages and backgrounds choose to engage with science at one of the UK's science and discovery centres or science museums. This equates to 385,000 people every week who come to our member centres to explore and discuss science in an involving and personal way. ASDC leverages this network to share the stories and science of STFC.

The Strategic Partnership and Previous Phases of Explore Your Universe

In 2011, The UK Association for Science and Discovery Centres (ASDC) and the Science and Technology Facilities Council (STFC) began an exciting strategic partnership which brought together some of the most fascinating and diverse cutting-edge science in the country with the talents and infrastructure of the nation's largest network of dedicated science engagement organisations. This pioneering partnership for the first time leveraged the reach and impact of UK science and discovery centres, which attract 20 million children and adults every year, for a research council.

The partnership began with a two-year national strategic programme called '*Explore Your Universe: from Atoms to Astrophysics*', which had the goal of 'inspiring a new sense of excitement amongst young people around the physical sciences by sharing the amazing stories and technologies of STFC'.

Phase 1 of this programme ran for two years (2012-2014). In the first year, ASDC worked with partners at the National Space Centre, Jodrell Bank Discovery Centre and the STFC facilities to create an exceptional set of hands-on activities, experiments, schools workshops, public shows, meet-the-expert sessions, website and a variety of other resources to share the inspirational science of STFC. Ten UK science and discovery centres were selected through an open tender process to be delivery partners, and they were trained, equipped and supported to run all these inspiring activities and share STFC stories and technologies with their visitors.

In just one year of delivery, Phase 1 engaged **156,880** people through a range of activities, including curriculum-linked workshops, family shows and meet the expert sessions. Over half of those reached were women and girls. This included 45,852 people who met an expert engineer or scientist, 59,236 who took part in the half-hour family show in a science centre, and 9,400 school students aged 10-16 who took part in a one-hour workshop. Also participating were 3,174 school students aged 14-16 who spent two hours exploring the latest science in the masterclasses, 1,225 teachers and 3,659 young people in 'badged groups' (brownies, guides, cubs, scouts etc.).

Phase 2 began in early 2014 and was completed in February 2016. It had the goal of increasing the number and breadth of young people who are inspired to explore the physical sciences by expanding, supporting and further developing the highly successful Explore Your Universe national strategic programme.

Applications were invited from new centres, through an open invitation to participate, and 10 new delivery partners were selected to deliver the whole Explore Your Universe programme. ASDC trained them via a training academy and supported them throughout their delivery with schools and families. Of the ten new Phase 2 partners selected, five were science centres and five were Universities. Phase 2 partners funded the purchase of their equipment (and some additional funds for capital were distributed in March 2015). During Phase 2, ASDC also supported and enhanced the work of the first ten Phase 1 Explore Your Universe delivery science centres to ensure they kept at the cutting edge of science and continued the learning and delivery in this area of high-end physics and engineering.

Phase 2 engaged 184,834 children and adults, in schools workshops, family activities and family shows across the UK. The total number of school children and members of the public who took part in Explore Your Universe Phases 1 and 2 came to a total of 341,714.



Explore Your Universe Phase 3

The Vision and overview of Phase 3

The vision of Phase 3 was 'To increase the value-for-money, sustainability and legacy of the Explore Your Universe Programme, further extending the reach into disadvantaged and underserved schools and communities to engage those who are remote from STEM (including geographically) whilst inspiring a sense of excitement around the physical science with young people and families, through sharing the amazing stories and technologies of STFC.'



Phase 3 aimed to consolidate all that had been done in Phases 1 and 2 and extend the reach further into disadvantaged and underserved schools and communities.

Delivery of Phase 3 was carried out by 14 Explore Your Universe partner science centres. 13 of these were existing partners who continued to develop strong community links and expertise in delivering Explore Your Universe in ways that celebrated STFC science with a range of audiences.

For Phase 3, a new centre, Techniquest Glyndŵr was added, bringing the total number of delivery centres to 14. Each centre received a grant of £3,000 to focus on engaging those remote from STEM (including geographically).

Participating centres chose how to run the programme to maximise their reach into areas remote from STEM. Some chose to organise outreach events involving visits to schools or other locations, others ran careers events involving local and national employers. Some centres chose to provide bursaries so that schools could pay the coach hire, teacher cover and entry ticket to come to their centres to take part in events that they may not normally have been able to afford.

The Phase 3 Delivery Partners

With the addition of Techniquest Glyndŵr the selected delivery partners for Explore Your Universe Phase 3 were:

1. Aberdeen Science Centre
2. Cambridge Science Centre
3. Catalyst Science Discovery Centre
4. Dundee Science Centre
5. Dynamic Earth
6. Glasgow Science Centre
7. Jodrell Bank Discovery Centre
8. National Space Centre
9. Science Oxford
10. Techniquest
11. Techniquest Glyndŵr
12. The Observatory Science Centre
13. W5
14. Winchester Science Centre



The Science Centre's Applications

Science Centres were invited to apply for grants to run activities in one, or a combination of the following areas.

1. Bursary Schemes to enable schoolchildren from disadvantaged areas (remote from STEM) to take part in Explore Your Universe curriculum-linked workshops

- a) Bursary Schemes for school children in disadvantaged areas of the UK, administered by the science centre, where the funding enables a student from a disadvantaged area to take part in an Explore Your Universe curriculum-linked workshop and to visit the science centre. Each bursary for a student would be around £2.50 - £4 depending on the science centre, meaning that for £3,000 could pay for up to 1,200 school students to take part.

- b) Travel Bursaries given to schools from deprived areas, particularly rural areas across Northern Ireland, Scotland and Wales, to enable those schools to pay for a coach to bring the school students to the science centres to take part in an Explore Your Universe curriculum-linked workshop. Each bursary for a coach carrying 52 students would be for around £100. £3,000 would enable around 1,560 students to get to the science centre.

Science Centres used the indices of deprivation (for each nation) and were encouraged to ask each school for their postcode to plot who has attended. ASDC have used the STFC definition of geographically remote from STEM to enable cross reference with other STFC data.

2. Teacher Training on Explore Your Universe activities

Some Science Centres run Teacher CPD programmes, to inspire primary school teachers especially, to run excellent and cutting-edge school science practical activities and lessons.

Science Centres with proven expertise in running teacher CPD would be able to apply for funding to run a series of CPD training sessions for teachers in their areas, using methods they have evidence attract teachers in their local area. Science Centres were encouraged to work with schools and local authorities that they already had relationships with to maximise the impact of the small grants. The goal was that all the Explore Your Universe curriculum-linked activities could then be repeated with school children year after year, celebrating STFC and UK science in schools across the whole region. The teachers that were targeted through this programme were from primary and secondary schools in the top 20% on the indices of multiple deprivation.

3. Outreach Programme for Explore Your Universe curriculum-linked workshops

A number of science centres were very keen to run Explore Your Universe curriculum-linked workshops and activities by outreach, taking the equipment, knowledge and great science activities directly into schools. However, they did not have the financial resource to do this.

Through this project, science centres could propose an outreach programme and would tell us what they want to do and how it would maximise the value for money by playing to their strengths using pre-existing infrastructure. In general, an outreach day would cost around £250 - £350 and they might see 4 classes in the school during the day = 120 children. Thus for £3,000, a Science Centre

could reach 1,200 children who don't usually engage with this science and are from a very deprived or remote area of the UK.

4. Inspiring Careers in Physics and Engineering

Science centres could apply to use the funding to run science careers events aimed at children from disadvantaged backgrounds. This might be whilst they are still at primary school, or in secondary schools.

Suggestions by ASDC included careers days focussed on inspiring girls with the physical sciences since evaluation shows that girls loved this programme of physics and engineering activities. ASDC did not advocate girls-only events, rather programmes and events that highlighted the range of ways into STEM careers for people from all backgrounds, both female and male.



The Selection Process

The invitation to participate was circulated to all Phase 1 and 2 Science Centre Partners. The ASDC team spoke with every organisation to discuss what they might do and how to apply. A bidder's conference call was held two weeks before the application deadline to answer any questions and give any guidance in a manner that all bidders could hear the answers. The selection panel reviewed the grant applications and 14 organisations were awarded a position as a Phase 3 delivery partner.

Adding Techniquest Glyndŵr

As part of Phase 3 of the Explore Your Universe programme, an additional small science centre partner with a reach of 75,000 per year was added. Techniquest Glyndŵr is a science centre based in Wrexham, North Wales with experience in delivering hands-on activities to schools and families.

Across all activities, Techniquest Glyndŵr engages with 35,000 school students and 40,000 community visitors every year. Adding Techniquest Glyndŵr to the programme enabled us to offer the Explore Your Universe shows and workshops to people residing in rural and other areas of North Wales for the first time.

Techniquest Glyndŵr has a track record of delivering quality STEM enrichment and enhancement activities, dating back to 2003. They have extensive links with schools across all six counties of North Wales, and each year engage with over 50 secondary schools and over 160 primary schools in North Wales. They provide access to STEM activities for schools and communities in low social-economic areas, including Communities First areas, areas high on the Welsh Index Of Multiple Deprivation (WIMD) and rural Welsh communities. Having Techniquest Glyndŵr as a delivery partner for Explore Your Universe Phase 3 enabled the programme to reach underserved schools and communities in an area not yet reached by any of the previous phases of Explore Your Universe.

Techniquest Glyndŵr were offered the full Explore Your Universe kit and were given extra equipment to use in EYU activities in place of items that they already owned. Members of staff were given three fully-funded places to the Training Academy, where they were trained on all the equipment, workshops and shows as well as all aspects of the programme. Although Techniquest Glyndŵr already has a strong reach into rural and underserved areas of North Wales, the Explore Your Universe kit (or aspects thereof) has enhanced their delivery of physics programmes where both staff and visitors are more informed of STFC science and engineering.



The Explore Your Universe Phase 3 Programme Goals

Explore Your Universe Phase 3 had the following programme goals

1. To provide further training and support to staff at Selected UK Science Centres to run all areas of the Explore Your Universe programme over two years.
2. To equip, train and support one new Science Centre in North Wales to run the whole range of Explore Your Universe family and schools programmes.
3. To run a full training academy for staff at selected science centres, to ensure that a wider range of staff in each centre have been trained in the full programme. This has been asked for by all the Science Centre's that ASDC had spoken to as many of the staff trained four years ago have changed jobs.
4. ASDC created and operated a peer reviewed grant giving framework whereby the selected science centres could apply for small grants of £3,000 each (total fund of £42,000), meaning 14 centres would be successful) to enable them to reach audiences remote from STEM.
5. ASDC would work closely with the STFC facilities and the STFC press team to identify appropriate STFC content that all the science centres should know about. ASDC would train the science centre staff involved on this new content. This was achieved through:
 - a. Regular conference calls with specialists, including the scientists and engineers
 - b. Regular newsletters giving the latest content to all centres
 - c. Targeted emails sharing the latest news and stories
 - d. Special newsletters about the James Webb Space Telescope as appropriate
 - e. Regular sharing of new ideas and activities and equipment between the centres (by any of the mechanisms above)
 - f. Regular phone conversation with the project manager to provide bespoke support to each partner and to highlight opportunities as they arise and to solve any issues before they become problems.
6. The website: ASDC created the Explore Your Universe website for Phase 1 in 2012. Since then the use of tablets and mobile phones to access content has increased dramatically and ASDC proposed updating the website to make it responsive and more usable on a range of devices, refreshing the content and functionality and links to social media. ASDC has completely recreated and relaunched this website.
7. A robust academic Evaluation of the Programme, in accordance with the new STFC PE framework using the Generic Learning Outcomes.

The Training Academy

The Phase 3 Explore Your Universe Training Academy took place at the UK Astronomy Technology Centre (UKATC) in Edinburgh on the 23rd and 24th of February 2017. It provided refresher training to participating centres in the Explore Your Universe programme, as well as full training to members of staff from new delivery partner Techniquest Glyndŵr.

Overall 18 members of staff from 12 science centre delivery partners attended. The programme included training on how to use all the equipment and resources, information on how to run the schools workshops and public events, guidance and details on the evaluation and reporting, as well as tours of the UKATC, talks from STFC researchers about cutting-edge science, and the chance to network with other science centre staff. Staff returned to their centres and then trained colleagues who also delivered the activities.

All delegates said that they ‘felt welcome’, ‘felt inspired’, and ‘felt that the training academy was directly useful’ to them. 70% of delegates rated the Training Academy as ‘excellent’, with the rest rating it as ‘good’.

“This was one of the best training courses I have been on! There was a variety of activities and content to keep you engaged, it was very well organised and we were well catered for. I hope that further opportunities arise like this.”

“A very well organised and run event. Thank you to STFC for hosting us and to ASDC for putting an excellent program together.”

ASDC thanks Dan Hillier and the team at Royal Observatory Edinburgh for their hospitality and inspirational talks. ASDC also thanks Sophie Allan from the National Space Centre for her contributions to the development of the programme and the presentation of activities and demonstrations at the Training Academy.



Explore Your Universe Phase 3 participant numbers

Explore Your Universe Phase 3 aimed to reach 15,000 people through what was originally going to be 15 delivery partners. These 15,000 people were to be made up of hard-to-reach audiences.

This number does not include the estimated 75,000 people engaging via continued delivery of the existing 23 Explore Your Universe partners using EYU equipment, EYU shows, workshops and stories. The delivery partners were selected from the original Explore Your Universe Phase 1 and 2 partners, with the addition of Techniquet Glyndwr.

Overall the Phase 3 partners exceeded the combined target of reaching 15,000 hard-to-reach audiences between them and reached a total of 39,273 people including communities, school audiences and even prisoner groups at a wide range of events throughout the UK.

Phase 1 delivery partners that were not part of Phase 3 have told us they continue to use the Explore Your Universe equipment and activities within their schools workshops and family shows, either as part of physics and engineering workshops or as the existing Explore Your Universe workshops and shows.



Quotes and insight from Participants

Quotes from Teachers:

- “Learnt so much, thank you... Absolutely amazing, loved it” (National Space Centre)
- “Our S1 students are developing their enquiry skills, thanks to Aberdeen Science centre [@AberdeenSci.](#)”
- “A big thank you to Aberdeen Science Centre [@AberdeenSci](#) for their work with S2 on technologies in physics and space.”
- “S1 STEM [@aberdeensci](#) delivered many fascinating scientific experiments. An insightful and hugely enjoyable afternoon! [@TheMorayCouncil](#)” (@ElginHighHT, Twitter)
- “Really engaging lots of activities and explanations to use with students and affordable” (National Space Centre)
- “Fantastic resources and engaging session... amazing ideas and fab resources” (National Space Centre)
- “Was amazing and much more useful than I could ever have expected... absolutely fantastic, best CPD. Sophie was amazing at adapting to our queries and needs” (National Space Centre)
- “(Lee) was very knowledgeable and passionate and explained things well... The session was fantastic – should definitely rebook” (National Space Centre)
- “Inspiring, amazing, motivating... Fun, inspiration ideas for me and the children” (National Space Centre)
- “What a fantastic session! Reinvigorated my love for science and I’m so excited to teach my science module this year, which I was dreading before” (National Space Centre)
- “The resources were inspiring to the children, explained well and linked continuously to what they are learning about and in response to children’s answers.” (Year 5 teacher, Observatory Science Centre)



- “My own subject knowledge is not good enough and I don’t have the equipment – my own science seminars during teacher training were very poor.” (Year 5 teacher, Observatory Science Centre)
- “Great ideas to take away and use with my class – especially for an NQT” (CPD, Science Oxford)
- “Hands on activities were excellent and well planned” (Teacher from Hawarden High School, Techniquest Glyndŵr)
- When asked what they liked about the activities: ‘Engaging presentation, pupils felt involved’ (Teacher, Cantell School, Winchester Science Centre)
- When asked what effect the activities may have on student’s long term motivation: ‘Show it can be fun, show it can have real uses’ (Teacher, Cantell School, Winchester Science Centre).

Quotes from schoolchildren:

- “I understand that. That is the first thing in science I actually understand.” (Year 10 student, Larne Grammar, W5)
- ‘I liked how he made learning fun!’ (Female student, year 7, Testwood School, Winchester Science Centre)
- When asked what they liked about the activities: ‘That it was not really a boring science lesson, it was fun, I liked it. I was intrigued about the colours’ (Male student, Cantell School, Winchester Science Centre)
- When asked if they will tell their family about the session: ‘Yes because it was a great experience that needs to be shared’ (Male student, year 7 Testwood School, Winchester Science Centre)
- When asked if they will tell their family about the session: ‘Yes because it inspired me, so it may inspire many others as well’ (Male student, year 7, Cantell School, Winchester Science Centre)
- When asked what they would remember: ‘With a special camera you can see through a bin bag’ (Female student, year 9, Woodlands Community College, Winchester Science Centre)
- “It was different because we don’t have this equipment in school...” (Year 5 student, Observatory Science Centre)
- “This was different as it was all way more dangerous...” (Year 5 student, Observatory Science Centre)
- “I think that this will help us with school science, I want to know more...” (Year 6 student, Observatory Science Centre)

Quotes from families and members of the community:

- “What you’re doing here is fantastic...the kids are like WOW!” (Parent, Dynamic Earth)
- “It was much more fun than school” (Holiday Club, Science Oxford)
- “The Plasma ball and the Van der Graaf machine. In fact the whole talk was fantastic. Thankyou!” (Audience member at family show 20/6/17, Techniquest Glyndŵr)
- “It’s great to have this on as part of our visit today, my daughter has really enjoyed it and I think it’s so important to let her see women are doing exciting things in science” (Parent, Dynamic Earth)
- “There’s so many different organisations here, really good event” (Parent, Dynamic Earth)
- “I liked talking to the marine scientist because I found out that microbes can help clean up oil spills and I think that’s cool” (Child, Dynamic Earth)
- “I think that things like this are great. Nothing like the science we did at school” (Adult, Dynamic Earth)
- “I think if you can capture kids’ imaginations then they’re hooked” (Adult, Dynamic Earth)
- “It’s great to see use of technology...the kids love it!” (Adult, Dynamic Earth)
- “Great to meet real scientists” (Child, Dynamic Earth)
- “Fabulous opportunity” (Adult, Dynamic Earth)
- “Good to hear ‘real stories’ about how people got into their jobs. Inspiring!” (Adult, Dynamic Earth)
- “The story telling helped make the stars more memorable” (Planetarium Show, Science Oxford)
- “Very informative talk and visual elements were very good” (Parent at home educator event, Techniquest Glyndŵr)
- “The show was really interesting and the experiments were cool” (Child at NAS event, Techniquest Glyndŵr)



Quotes from Dynamic Earth visiting scientists, engineers and experts:

- “This event was so well organised and gave us a great opportunity to practice public speaking and outreach skills” (Exhibitor, Dynamic Earth)
- “Great to meet such a diverse audience at one event” (Exhibitor, Dynamic Earth)
- “It was great to see parents make a genuine attempt to understand and encourage their children, as many will simply dismiss physics as ‘too hard’” (Exhibitor, Dynamic Earth)
- “We got to inspire and show the teachers that simple experiments and exercises can explain effectively big scientific concepts” (Exhibitor, Dynamic Earth)
- “It was great to meet young people interested in the engineering industry” (Exhibitor, Dynamic Earth)
- “It was great to talk to so many enthusiastic school kids and also meeting teachers and parents (this was particularly useful)” (Exhibitor, Dynamic Earth)
- “Anything that encourages children into STEM careers is worth supporting. So many of the Royal Navy’s Career pathways rely on STEM interest and qualifications.” (Exhibitor, Dynamic Earth)
- “It was great to give children an insight into the work and opportunities in civil engineering” (Exhibitor, Dynamic Earth)
- “Children taking an interest in our industry; taking away fun facts and ideas for careers which span far more than engineering e.g. Geology and GeoSciences [was the most worthwhile part of the event for me]” (Exhibitor, Dynamic Earth)



Quotes from workshop participants at Her Majesty's Prison Leicester

- “Thought the afternoon was fantastic... Brilliant and very insightful”
- “Had some very good conversations and discussions”
- “Very interesting. Andy done very well dealing with the abundance of questions thrown at him, some all at the same time. Really enjoyable”
- “It was a good session. Everyone got involved. Teacher was an OK fellow”



The Academic Evaluation of Phase 3

As in previous phases, the programme was evaluated independently by Professor Justin Dillon and Dr Ana Moncada Arce at The University of Bristol. The overarching purpose of the evaluation was to assess the programme's impact and success. The evaluation was also designed to provide information to partners to help them to reflect on their experiences and, thus, inform any future initiatives.

The Evaluation Programme for each Science Centre

The Phase 3 Explore Your Universe team worked closely with STFC to achieve the following goals:

1. To create an evaluation programme that fits with the new STFC evaluation framework which uses the Generic Learning Outcomes (GLO's).
2. To evaluate the efficacy and value of the bursary programme run by science centres in reaching underserved groups.
3. To evaluate the efficacy and value of the outreach programme run by science centres in reaching underserved groups.
4. To evaluate the efficacy and value of the CPD programme run by science centres in reaching underserved groups.
5. To evaluate the efficacy and value of the systems, processes and support that ASDC have created and delivered to make Explore Your Universe a success. This will be achieved by interviewing the staff delivering the programme in the science centres, asking about the impact on them, and their science centres.

Phases 1 and 2 of this programme marked a huge opportunity to collect a robust, national, multi-centre dataset demonstrating the impact science and discovery centres can have on families and students. Explore Your Universe Phase 3 gave us the chance to analyse which elements of the bursary schemes and outreach programme teachers and students value most and which of the processes are key to making the programme so successful nationally.

The evaluation included a series of standardised evaluation forms as outlined in the table below. These evaluation forms were completed by visitors and input electronically by science centre staff. Time to complete the forms was given to teachers and participants where required. Outreach activities and workshops were delivered in a way that allowed participants time and space to answer the questions thoughtfully.

Timeframes and deadlines for science centres

The standardised evaluation forms were given to centres in April 2017 ready for the delivery of the first project activities. In addition to collecting and submitting this information, key members of staff from each science centre were interviewed on the phone by Justin Dillon. All evaluation data was input online by December 1st 2017. Metric data was also collected around this date, where updates were made once the final report was submitted on January 20th 2018.

Explore Your Universe Phase 3 Evaluation Programme

A	Evaluation form for Science Centre Staff at CERN February 2017	Evaluation form, administered by STFC through Smart Survey
B	Evaluation form for Science Centre Staff at Training Academy February 2017	Evaluation form, administered by STFC through Smart Survey. Academy delegates to use laptops
C	6 month follow up Evaluation form for Science Centre Staff who were at Training Academy - September 2017	Evaluation form, administered by STFC through Smart Survey
D*	Single Evaluation form for Teachers of 14-16 year olds in masterclass and of 10 – 13 year olds in schools workshop	Two-page paper evaluation form*, given to every teacher and administered by science centre For Bursaries and Outreach and visiting
E*	Evaluation form for Teachers who have taken part in CPD	Two-page evaluation form, administered by science centre
F*	Bursary Students: Evaluation form for Students of 10 – 16 years in schools workshops	Two-page evaluation form, administered by science centre 7 classes (minimum 210 children)
G*	Outreach Students: Evaluation form for Students of 10 – 16 years in schools workshops	Two-page evaluation form, administered by science centre 7 classes (minimum 210 children)
H	Telephone interviews of Science Centre Staff from Training Academy to give richer qualitative data 10 months on in January 2018	Administered by University Researcher. Contacts supplied by the science centres. Times arranged initially by ASDC
I	Collecting Quotes from a sample of Families and Community outreach	Providing a book where they can write what they enjoyed or what they thought about the activities and any other comments.
J	Metrics Sheet All audiences and activities:	The metrics sheet will capture numbers, approx. age make up of groups and postcodes of the events in communities
H	Career Events	

* Denotes the items where science centre assistants will need to input the answers into the form provided.

Evaluation data collection

As seen on the page previous, the evaluation consisted of a series of standardised evaluation forms and telephone interviews with staff at the participating centres. A short evaluation form was designed for students who participated in the activities. This form was given to three different groups of students: Bursary students, Outreach students and Career Event students. Two evaluation forms were designed for teachers; one corresponds to the evaluation of a continuing professional development activity (Teacher CPD questionnaire) and the other targeted the teachers who attended the activities with their classes (School Event Teacher questionnaire).

Participating centres were asked to ensure that the evaluation forms were completed by a specified minimum number of students and teachers taking part in the project activities. Centres were asked to allocate appropriate time for participants to complete the forms. Responses from the paper evaluation forms were entered by volunteers and staff at each centre into an online survey database.

Evaluation Methodology

1. Evaluation forms and questionnaires

Each questionnaire includes multiple-choice questions and open-ended questions. Quantitative analysis was used to examine the responses between different groups who took part in the evaluation. Specifically, differences in the responses between primary and secondary students; between genders, and between students who attended from more deprived schools¹ and less deprived schools² were tested. Due to the characteristics of the data, the main test that was conducted in order to find whether there were any significant differences between groups was the t-test (see page 16 for an explanation of this method). Descriptive statistics for the respondent group and the responses are also provided for each question.

The analysis of the open-ended questions followed a more holistic approach. Thematic analysis was used to recover the main themes for each question. These were then compared across similar questionnaires (Bursary, Career event and Outreach). Major differences within the responses among these questionnaires are explicitly highlighted. The teachers' open-ended questions were also analysed using thematic analysis. Within each teacher evaluation form (School and Career event, Teacher questionnaire and Teacher CPD questionnaire) each question was analysed independently.

2. Telephone interviews

Each centre was asked to nominate a member of staff to take part in a Skype or telephone interview with Professor Justin Dillon. Participants were given a list of discussion topics in advance and calls lasted between 30 minutes and an hour. The interviews were audio-recorded and independently transcribed. Participants were offered the chance to receive a copy of the transcript if they so wished.

¹ The Index of Multiple Deprivation (IMD) was used to classified schools by their postcode. The most deprived schools were located in areas within the first quintile of the IMD (lower IMD).

² The Index of Multiple Deprivation (IMD) was used to classified schools according its postcode. Thus, least deprived schools were located in areas within the fifth quintile of the IMD (higher IMD).

Evaluation programme targets and actual number of participants

Each Science Centre was delivering to different groups and to different numbers of people to have sufficient evaluation responses to analyse in each group, whilst giving each centre approximately the same number of evaluation forms to complete, the following grids were drawn up of how many forms of which type each centre needed to get completed and to submit to the independent evaluators.

The final number of required evaluation forms from each centre is shown in the Table 2:

Table 2. Target number of surveys required from each centre (n=14)

Centre	Final Sample Size required								Total
	Outreach		Bursary		Careers/Other			CPD	
	Primary	Secondary	Primary	Secondary	Teacher	Student	Public	Teacher	
Aberdeen Science Centre	120		120						240
Cambridge Science Centre	150	60							210
Catalyst Science Discovery Centre	120		120						240
Dundee Science Centre		210							210
Dynamic Earth (two day Careers Event)						180	30		210
Glasgow Science Centre (three day Careers Event)					*	*			210
Jodrell Bank Discovery Centre		30		180					210
National Space Centre (Prisoners)							*	*	**
Science Oxford (Holiday Clubs)		*			*	*	*	*	210
Techniquest			270						270
Techniquest Glyndwr		90		120					210
The Observatory Science Centre	210								210
W5		30		180					210
Winchester Science Centre		210							210
Total	600	630	510	480		180	30		2850

**No strict constraint of 210 evaluations

The overall number of responses to the surveys was achieved. However, the distribution of these responses varies from the original requirement. Table 3 summarises the number of responses that each centre submitted for the programme evaluation.

Table 3. Actual number of surveys returned by each centre (n=14)

Science Centre	Bursary Student Questionnaire	Careers Event Questionnaire	Outreach Student Questionnaire	School and Career Events Teacher Questionnaire	Teacher CPD Questionnaire	Total Responses
Aberdeen Science Centre	160	0	996	13	0	1169
Cambridge Science Centre	0	0	299	39	0	338
Catalyst Science Discovery Centre	213	0	122	0	0	335
Dundee Science Centre	0	0	530	6	0	536
Dynamic Earth	0	124	0	3	0	127
Glasgow Science Centre	0	229	0	0	22	251
Jodrell Bank Discovery Centre	173	0	52	0	0	225
National Space Centre*	0	0	0	0	14	14
Science Oxford	0	0	25	0	48	73
Techniquest	0	0	281	10	0	291
Techniquest Glyndwr	232	0	58	23	0	313
The Observatory Science Centre	0	0	333	21	0	354
W5	181	0	103	8	0	292
Winchester Science Centre	0	0	171	6	0	177
Total	959	353	2970	129	84	4495

Activities in Phase 3

Participating centres chose to organise outreach events involving visits to schools or other locations and/or careers events involving local and national employers. Some centres chose to provide bursaries so that schools could take part in events that they would not normally have been able to afford.

More than 39,000 people participated in different activities in Phase 3. Table 1 shows the total number of participants by centre and by activity:

Table 1. Numbers of participants for each science and discovery centre (n=14 centres)

Science Centre	Students			Teachers				People			Total
	Outreach	Bursary	Schools Careers Events*	Outreach	Bursary	Schools Careers Events*	Teacher CPD	Families or Communities	Careers Events	Other EYU activities	
Aberdeen Science Centre	1631	1257	0	20	83	0	0	18944	0	18	21953
Cambridge Science Centre	918	0	0	77	0	0	0	970	0	100	2065
Catalyst Science Discovery Centre	160	440	452	8	60	39	0	0	0	431	1590
Dundee Science Centre	1439	0	0	68	0	0	0	125	0	0	1632
Dynamic Earth	0	0	0	0	0	0	0	600	1100*	536	2236
Glasgow Science Centre	0	0	0	0	0	0	0	0	620**	0	620
Jodrell Bank Discovery Centre	1532	587	0	47	17	0	0	0	0	0	2183
National Space Centre	0	0	0	0	0	0	14	18	0	0	32
Observatory Science Centre	767	0	0	26	0	0	0	0	0	0	793
Science Oxford	0	0	0	0	0	0	110	150	180**	0	440
Technquest	0	1287	0	0	10	0	0	0	0	0	1297
Technquest Glyndwr	346	255	0	20	20	0	0	961	167**	30	1799
W5	668	259	0	26	12	0	0	0	0	0	965
Winchester Science Centre	1375	0	0	43	0	0	0	0	0	250	1668
Total	8836	4085	452	335	202	39	124	21768	2067	1365	39273

* Schools and public audience

** Schools audience

Student and Teacher evaluation forms

Three questionnaires were developed for collecting students' opinions on whichever type of activity they took part in. Centres returned responses from 4,282 students with some centres returning far more than was requested. In order to have adequate representation for each centre, 2,542 responses were randomly chosen to be analysed. Thus, for each questionnaire, the numbers of responses from females and males are similar. The number of responses from students who attended from more deprived schools (lower IMD) is greater than responses from students who attended from less deprived schools (higher IMD). This difference is because the focus of this phase of EYU was on schools that might not normally take part in such events. The quantitative analysis of the student questionnaires can be found in the full report, followed by the qualitative analysis.

Two evaluation forms were developed for collecting teachers' opinions. Centres provided responses from 213 teachers. The quantitative analysis of the responses focuses on the differences between the two groups of teachers - those who work in more deprived schools (lower IMD) and those who work in less deprived schools (higher IMD). For each questionnaire, the number of responses from teachers who work in more deprived schools and those who work in less deprived ones can be significant and, therefore, a statistical test was not always possible. Nevertheless, descriptive statistics are always offered. This analysis can be found in the full evaluation report.

Findings from the Academic evaluation

The evaluation of Phase 3 of Explore Your Universe (EYU) commenced in April 2016. In total, 39,273 people participated in events in 14 science and discovery centres. The evaluation draws on response from 213 teachers and 4,282 students.

Feedback from both students and teachers was very positive with, for example, 98% of the 129 teachers surveyed reporting that they would recommend the activities to colleagues. Boys and girls were equally positive about the activities with some slight differences for some aspects. Students from schools in areas of higher deprivation were slightly more positive about the activities than students from schools in areas of lower deprivation although both groups were overwhelmingly positive. Almost four out of five students found the activities inspiring. Significant numbers of students reported that they were more likely to consider a career in STEM after taking part.

The main findings are as follows:

1. Of the students whose schools had received bursaries to participate in events, 89% rated the EYU activities as 'Very Good' or 'Good'. Primary school students (92%) were more positive than secondary school students (87%).
2. Students from schools in areas of higher deprivation (91%) were slightly more positive about the activities than students from schools in areas of lower deprivation (88%).
3. In total, 79% of students felt inspired by the activities. More primary school students (87%) were inspired than secondary school students (75%).
4. More students from schools in areas of higher deprivation (83%) were inspired than students from schools in areas of lower deprivation (80%).



5. Three-quarters of students said that they would tell friends and family about the activities with female students being more positive, especially those from primary schools.
6. More than half the students reported that they had never used the equipment in the activities before.
7. Most students (60%) reported that they thought the activities would be useful for their science classes. Primary students were more positive about this aspect than secondary students, and, particularly, primary students from more deprived schools.
8. More than half the students were more likely to consider a career in STEM after taking part in the activities (53%). The likelihood was greater for primary than secondary students. Similarly, male students were more encouraged by the activities than were female students.
9. Half of the students reported that they knew about the type of research described being carried out in UK. However, secondary students were more aware than primary students, and among secondary students, males claimed to be more informed.
10. The evaluations from students who took part in careers events run by two centres were equally positive (n=353 students). Most of the participating students positively evaluated the overall activity (91%). Primary students were significantly more positive about the activity than secondary students. Similarly, female students were more positive than male students, and students who attended more deprived schools were more positive about the activity than students who attended less deprived schools.
11. Ten centres organised outreach activities and reached 9,171 participants. Most students gave a positive evaluation of the overall activity (85%). Primary students were significantly more positive about the activity than secondary students. Similarly, primary female students were more positive than male students, and primary students who attended more deprived schools were more positive about the activity than students who attended less deprived primary schools.
12. Students valued the interactivity of the activities and reported learning something new. Students liked the hands-on nature of the activities and enjoyed using sometimes novel equipment.
13. A total of 129 teachers participated in the evaluation for these activities from nine centres. Overall, 93% of the teachers gave a positive evaluation of the activities. And almost all teachers (98%) would recommend these activities to other teachers.
14. The funding for visiting the centre was crucial for teachers; if the cost is covered then over 90% of teachers reported that they would take students to a science centre or arrange an outreach visit. With no cost cover this percentage dropped to 30% and 43%, respectively.
15. The content of the workshops, the scientific equipment and the expertise of the centre staff were uniformly evaluated very positively. The content and the equipment were slightly better evaluated by teachers who were visited by a centre (outreach) than by teachers who visited a centre. Teachers from more deprived schools were more positive about the content and the expertise of staff than those who work in less deprived schools.

16. Most teachers (77%) reported that they would talk with their students about the EYU content in the future. Two-thirds of the teachers reported that they were interested in attending CPD on this topic.

17. Most of the teachers did not know about STFC before the activity (88%).

18. Interviews with staff from the 14 participating centres found very high levels of enthusiasm for EYU project. Centres felt part of a national project that was well supported by ASDC and STFC. Whether or not centres had been involved in designing and writing the activities, there was high praise for what had been provided.

19. All centres benefitted substantially from the funding which allowed them to engage with new schools or to strengthen existing relationships. Some centres had identified strategies to ensure that these links could be maintained after the project finished. Many centres seem to have benefitted from a focus on outreach to schools and, in one case, to a prison. Centre staff felt more confident in delivering EYU-type activities beyond their own institution.

20. The kit was uniformly valued as one of the major legacies of the project particularly as there are few consumables to be replenished. Particularly popular parts of the kit were the heat-sensitive camera, the Van de Graaf generator and the emission tubes.

21. All respondents reported enthusiastic responses from students. Some thought that this response was identical between boys and girls however some respondents thought otherwise. Some respondents reported that girls were more engaged and able to interact with presenters and visiting scientists; other respondents thought that 'science is for boys' was a stereotype displayed by students and, more worryingly, by accompanying adults.

22. The centre staff presented a picture of the UK schooling system that was worrying. Inadequate funding for travel, poor classroom resources and teacher shortages were mentioned. Weak teacher knowledge of science topics was also raised as an issue. These perceptions only reinforce the value of science and discovery centres in the science education of young people.



The impact on Science Centre staff

A member of staff from each participating centre (n=14) was interviewed via the telephone or via Skype. Participants were given a list of discussion topics in advance. While some of the centres had been involved in previous phases of EYU, one centre had not and in a few cases interviewees had not attended the training academies.

Overall, the participants were very enthusiastic about their centre's EYU experiences and felt part of a national project that was well supported by ASDC and STFC. Whether or not centres had been involved in designing and writing the activities, there was high praise for what had been provided. This finding is, perhaps, unsurprising since this is Phase 3 of the project.

Impact of the project on centre staff and activities

All centres benefitted substantially from the funding which allowed them to engage with new schools or to strengthen existing relationships. Some centres had identified strategies to ensure that these links could be maintained after the project finished. Many centres seem to have benefitted from a focus on outreach to schools and, in one case, to a prison. Centre staff felt more confident in delivering EYU-type activities beyond their own institution.

Links with other organisations

In a number of cases, the project encouraged the development of greater links between the centres and local institutions such as schools, universities, third-sector organisations and industry.

STFC

All the respondents appeared to understand the role and function of the STFC and could identify ways in which they had integrated this understanding into their shows, talks, etc. The STFC Twitter feed seemed to be a particularly good source of up-to-date materials.

The materials

Particularly popular parts of the kit were the heat-sensitive camera, the Van de Graaf generator and the emission tubes. The kit was uniformly valued as one of the major legacies of the project particularly as there are few consumables to be replenished.

Impact on visitors

All respondents reported enthusiastic responses from students. Some thought that this response was identical between boys and girls however some respondents thought otherwise. Some respondents reported that girls were more engaged and able to interact with presenters and visiting scientists; other respondents thought that 'science is for boys' was a stereotype displayed by students and, more worryingly, by accompanying adults.

The topics

Almost all the respondents thought that today's audiences were keen to know about space. Many referred to the "Tim Peake effect". One centre had seen a dip in interest in space this year compared with last but they were still getting good bookings for their primary space-related workshops.

Schools

The centre staff presented a picture of the UK schooling system that was worrying. Inadequate funding for travel, poor classroom resources and teacher shortages were mentioned. Weak teacher knowledge of science topics was also raised as an issue. These perceptions only reinforce the value of science and discovery centres in the science education of young people.

The EYU website

The EYU website was used by the respondents but not a great deal. The Scottish centres meet regularly (quarterly) but contact between centres in England was more *ad hoc* – because of the greater distances involved in meeting up.

The evaluation

The evaluation process was seen by some centres as rather onerous for some of the primary school students.

Post-project meeting

Some respondents expressed a desire for a post-project meeting to share experiences.



The New Website

ASDC provided a range of support to science centres across the programme. This included a new and improved website www.exploreyouruniverse.org.

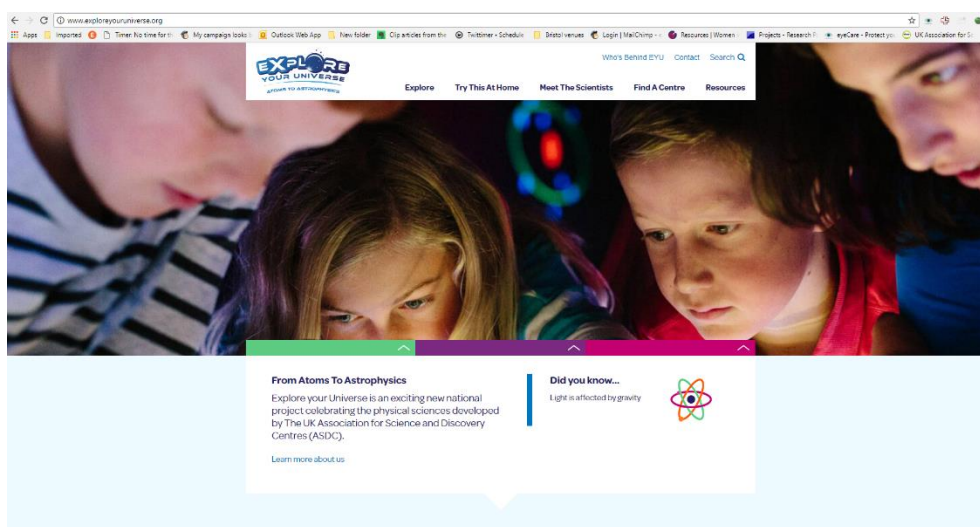
Since ASDC created the first EYU website in 2012, there has been a huge increase in both smartphone usage and social media use. The older EYU website had a forum for people to talk which is now much more easily done on social media, along with a format that was difficult to use on mobile phones as it had been created for use on a screen.

The website also was redesigned to make it more public-facing, with a 'Try This at Home' section full of experiments. This will increase with time. It also has a 'Meet The Scientists' section with a host of profiles showcasing researchers from STFC facilities.

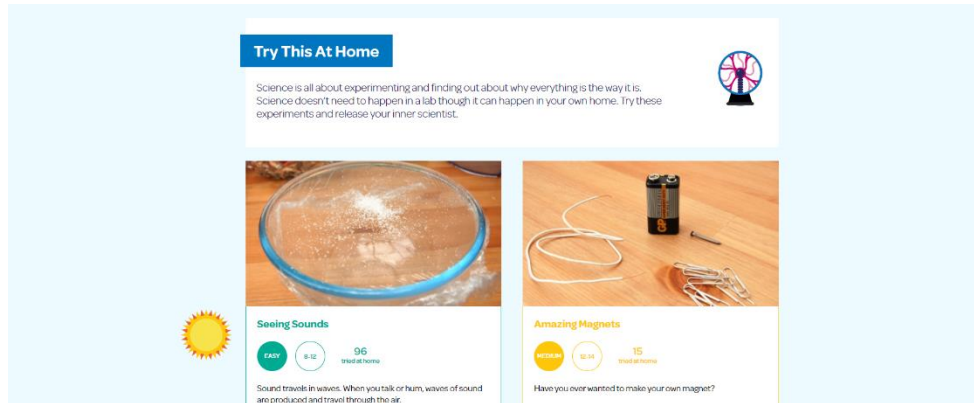
The previous Explore Your Universe Website



The new Explore Your Universe Website - Home page



The new Explore Your Universe Website – Try this at home



Science Centre feedback on the Website

For the redevelopment ASDC asked delivery partners to provide feedback on the Explore Your Universe website and how they used it and this informed the redevelopment. All 14 Science Centres were consulted, and their thoughts are summarised below.

79 % used it occasionally and 14 % never used it. Those who used it valued it for finding up to date news and research stories, additional support e.g. further safety guidance on Van de Graaff Generator or for notes on the light spectrum tube, and for the resources if they didn't have the handbook with them.

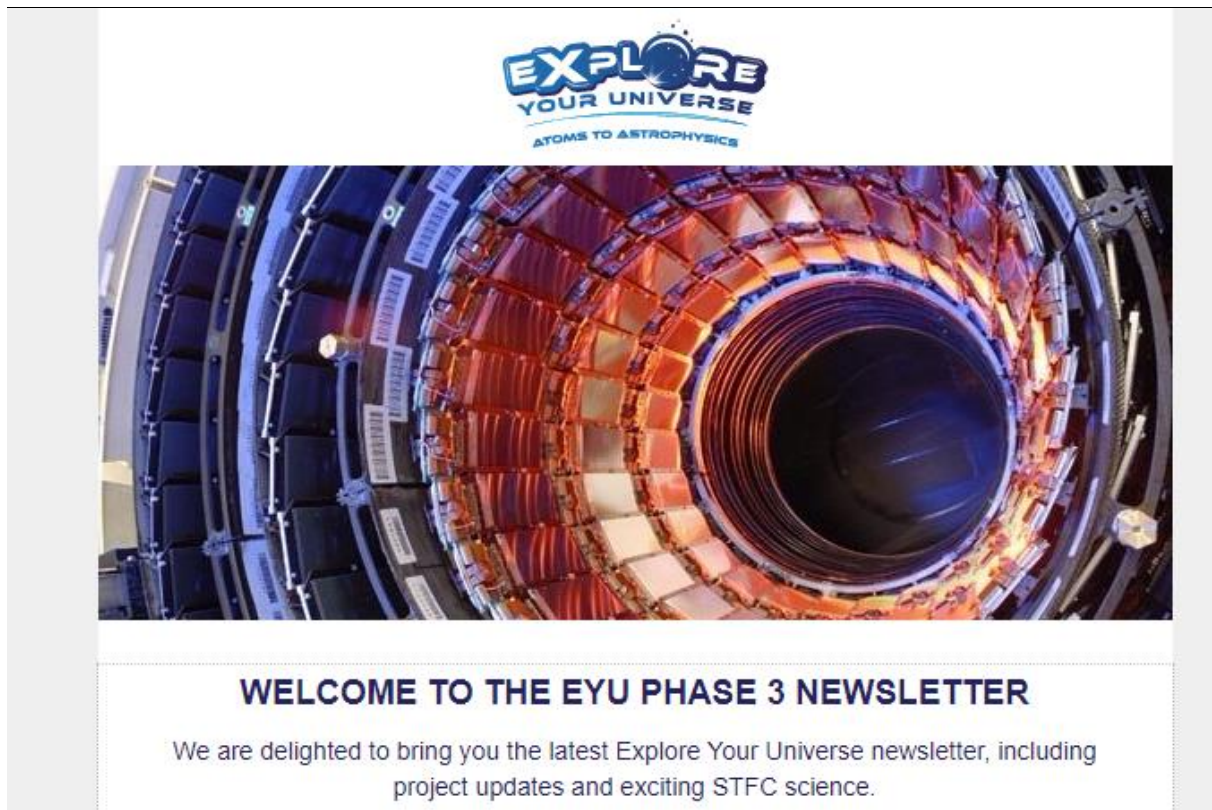
43 % said they found it Quite useful and 29 % Somewhat useful, with the following comments

- Our social media interactions (particularly Twitter) with EYU, ASDC and STFC was probably the most valuable online presence. This helped us create networks and context for our own events as well as news and research.
- Members of staff new to the project were able to explore the website, along with STFC and ASDC websites to gain a better understanding for the project and find further information.
- The website had lots of content and a good source of information.
- It was a good place to find up-to-date information on STFC projects. However, the website does contain a huge amount of information with updates from STFC multiple times daily. Unfortunately, pulling out the key pieces of information from this website was time consuming.
- The website was useful as a reference when developing the workshop.
- The videos on the site were useful and interesting.

The EYU Newsletter and additional support

ASDC provided a range of additional support to science centres across the programme. This included on the phone support, conference calls, newsletters and a new and improved website. There was also a trip to CERN organised to enhance the knowledge and enthusiasm of a key member of personnel from each Science Centre.

We have been sending all partners a regular newsletter containing project updates and STFC science stories and news, as well as using conference calls to share skills and expertise.



The Trip to CERN

Thanks to generous funding from STFC, ASDC were delighted to be able to offer a trip to CERN to one member of staff at each EYU delivery centre. This trip took place on the 9th and 10th February 2017 and was attended by 20 staff from 20 EYU delivery partners attended.

The trip included tours around many of the facilities at CERN, including the Large Hadron Collider, as well as talks from researchers and the chance to network with other engagement professionals.

All delegates rated the trip as 'excellent', and all 'felt inspired' and said they will "use the story of the LHC and CERN to add context to other activities they deliver"

Many thanks to STFC and Steph Hills at CERN for funding and hosting us.



Legacy and looking to the future

Explore Your Universe Phase 3 follows on from the enormous success of Phase 1 and 2. Overall, 341,714 school children and members of the public took part in Explore Your Universe Phases 1 and 2. A further 39,273 people took part in Phase 3, predominantly from disadvantaged communities and schools. This brings the final numbers to 380,987 people who have taken part in specific Explore Your Universe workshops, family shows and activities.

However, the legacy is substantially wider than this. Overall the programme has made a step change in the way the science engagement community across the UK deals with physics and engineering and the skills with which they bring the stories and science alive with families and schools. It has also given the UK an army of professional staff the excellent kit, hands on resources and experiments to use into the future.

This is a significant change nationally. When this programme began we knew there were only a handful of science centres and organisations that could confidently talk about particle physics, particle accelerators, the instruments on telescopes in space and the latest physics research.

We know that this has radically changed and science centre staff across the UK are now much more likely to deliver physics and engineering programmes than they were five years ago.

In addition, they have over the past years, built relationships with the physics and engineering departments of their local universities and with the STFC facilities. None of those who came to CERN on either of the ASDC -STFC visits had ever visited CERN before. Only two had been to a particle accelerator in the UK. We know from what these staff have told us 'that when they show children photographs of themselves next to the detector at CERN, the children say it feels possible that one day they might go there too - it becomes a tangible reality. The impact of this can't be underestimated if that child begins to feel that research is for them.

Clearly from the evaluation, there is also a huge impact on the teachers across the programme, most of the long-term impact of which is not captured. They frequently say things like 'Brilliant, I can show the CERN videos to my students' or 'we have a Van de Graff and spectroscopes in the cupboard, I will go back and start using them'. This programme has also made a major step forward in reaching those remote from STEM with the great science, and this will continue for years to come.

ASDC and STFC pioneered the largest academic impact evaluation of any science centre programme anywhere in the world during Phase 1. What would be excellent now is to look at the longer-term impact of this programme, in a way that pioneers long-term impact studies for the UK science engagement sector and science centres worldwide.

Summary

Explore Your Universe Phase 3 has proven that this programme continues to play a big part in engaging both school children and the public with Physics and the inspiring nature of STFC science and research. The successful delivery of the programme highlights that the programme is engaging and robust and we have strived to ensure it is still as applicable and up-to-date as when it was created. The continued delivery by, and support of the Phase 1 and 2 centres highlights the legacy that this programme has created.

The programme continues to inspire males and females equally and appears to be having a significant impact on raising the level of interest in physics in girls, highlighting the importance of this type of hands-on practical science engagement programme.

This programme along with its materials and equipment will have a lasting legacy on all of the delivery centres and partners involved ensuring they continue to share STFC science and remain at the forefront of physics engagement.

We thank STFC for having the vision to fund Explore Your Universe which we believe has made a step change to the quality and reach of hands-on engagement with the latest physics and engineering in the UK.

Delivery by the Science Centre Partners

Case Studies from Science Centres

Science Centres were all asked to pull out one case study from their vast number of events and activities from this Phase of Explore Your Universe. These are all summarised below, followed by other areas that the programme wanted to highlight.

Please note, there is another report with all the full reports from the science centres, available on request.

Aberdeen Science Centre

Our coordinator delivering the Secondary school programme was approached by several members of staff before/during delivery, often during turn-around between shows and while setting or clearing up. The staff were incredibly curious about the equipment being brought in and generally about ASC as we have not visited these schools before. The staff had different experiences with science ranging from active science teachers to administration staff for whom 'science was not for them'. The key piece of equipment that stood out was the Van de Graaff generator because staff would often recognise this equipment from when they were at school. What was particularly encouraging was that this key piece of equipment had obviously, at some point during their education, excited and inspired them enough to make a lifelong impression.

To take the knowledge that one exciting piece of equipment can inspire an interest in STEM into a show for young people, is incredibly exciting. While it is too soon to know what the long term impact of this show is, the thought that the show might have made a lifelong impression on the pupils was a very rewarding moment.

Dundee Science Centre

Running secondary school EYU events as outreaches allowed DSC to engage more schools that otherwise would not have engaged with the project due to logistical issues with bringing a secondary class out of school. Running assembly demo-shows also allowed the project to reach higher numbers of pupils, especially with repeat sessions in each school. The EYU demonstrations and content about STFC's science were easy to adapt to this demo-show format. Other demonstrations were also included, such as the hydrogen balloon and whoosh bottle from the Destination Space project, illustrating the most common element in the universe and an exothermic reaction for the infrared camera respectively; and using keyhole surgery and photodynamic cancer treatment as relatable example applications of fibre-optics and lasers. This combination of demonstrations and format allowed DSC to provide a dramatic, engaging demo-show, with a variety of everyday and 'cutting edge' research applications to explain the fundamental science behind STFC's work, and bring it to the widest possible audience of secondary pupils from disadvantaged areas to inspire them about science.

Dynamic Earth

For Phase 3 of the Explore Your Universe Programme, Dynamic Earth organised a two-day Inspiring Young Scientists Showcase which targeted family, community group and school audiences. Targeted marketing from across different strands of our team meant that a high proportion of visitors who came to the showcase were from harder to reach backgrounds; more than 60% of school pupils who attended came from schools with an Scottish IOMD within the top 20% or higher, and 22.5% of family visitors came from communities in the top 25% on the Scottish IOMD, with 12.5% of visitors coming from communities in the top 5%.

The showcase event brought together more than 20 different organisations and research teams working in STEM industry and research to Dynamic Earth in the form of marketplace stalls for visitors to engage with freely, and I asked her face to face interactions, hands-on activities and demonstrations. More than 50 representatives from STEM research and industry staffed the showcase – with a vast majority of representatives being scientists (including engineers). Around 65% of the exhibitors at the showcase were women working in STEM research and industry. Across both days of the event, more than 1,100 visitors engaged with the showcase and met a real scientists or engineer. To provide an element of longevity to the showcase and prevent helicoptering style engagement, Dynamic Earth put together a booklet of ‘Career Profiles’ for visitors to take away with them following the showcase. These provided profiles on the background and ‘STEM journey’ of 20 of the scientists who exhibited at the event, and aimed to act as a resource of guidance and inspiration for young scientists of the future.



Winchester Science Centre

Audience driven modification of content

Abstract:

Through phase 1 of Explore Your Universe at Winchester Science Centre the content provided by the ASDC and STFC was refined into a 45-minute small group show designed to work as a complimentary session with the mobile planetarium offering. Successfully winning phase 3 funding allowed the team to further modify the session making it a stand-alone 'workshop in a box' that any member of staff, with sufficient training, could deliver. However, this did not take into account the time pressures faced by targeted KS3 schools and the necessity of much larger audiences, justified by having a lower impact on the teaching timetable within schools. Modifications were made to make the session more dramatic and appropriate for larger audiences and the feedback received improved as a result.

Method:

After the first outreach delivery at Mountbatten School it became apparent that the as-designed show was not suitable for larger audiences, Phillip Lemon led a series of modifications which improved and focused the story being told, reflected in increased confidence of the presenter and positive feedback from schools.

A wavelength proving experiment using chocolate and a microwave was introduced, with students encouraged to 'try this at home', mass audience participation was achieved using a glow stick representation of the visible part of the electromagnetic spectrum and the discharge tubes were improved by introducing diffraction glasses and the concept of spectral analysis. A series of thought experiments were also introduced, encouraging students to predict and discuss the outcome of a fly striking a moving train and the implications for acceleration and the forces involved. A series of discussions on the nature of colour were introduced to foster delight and productive cognitive dissonance and Phill drew from his own personal experience and dissertation to discuss the observations of extra-solar phenomena under different wavelengths of light.

Impact and lessons learnt:

This project highlighted the challenges of closed-room development and the dangers of assuming the scalability of demonstrations. The changes made allowed the scaling up of a show best suited for ~ 40 audience members to reach over 200 at a time. These changes also improved the confidence of the presenter and allowed much more flexibility in working with schools. It is likely that without the changes made, none of the target schools would have been able to benefit from the programme due to the timetable constraints. Future similar projects will be co-developed with the representatives of the recipients to ensure that activity is effective as well as being sustainable.

Catalyst Science Discovery Centre

The staff at Catalyst Science Discovery Centre tackled the challenge of finding Primary school audiences creatively. Their aim was to entice twelve Primary classes into the museum to participate in EYU activity. These schools were to be within the top 25% of the deprivation scale. Money was to be awarded covering the costs of workshops but schools had to burden the cost of transportation.

Clare Hampson, Education Manager at Catalyst, and Phil Day, Public Engagement Manager at Daresbury Laboratory (STFC) worked together to create something big, bringing STFC science, including the science from the EYU programme, to schools across Halton. This produced a full week of inspirational science activities for some of the most deprived pupils in the area. Schools taking part were to be selected by a panel including representatives from Halton Borough Council. The aim of the collaboration was to create memorable learning experience for the children, bringing STFC science alive, and maximising the impact.

As part of National Space week's programme there were 129 separate activities, included in those were nine EYU shows and nine Destination Space shows at Catalyst, plus activity from a team at Liverpool John Moores University and STFC Daresbury Laboratory. There was an estimated engagement time of 96 hours.

"This project was all about reaching schools that drew children from the most deprived communities in the borough. We wanted to deliver something that would live long in the memory, encourage children to talk to family and others about space and science, and increase confidence and aspirations in STEM. We hoped that by engaging 'en masse' and intensively with schools in Halton over a week that this might fuel conversations between families across the borough about the week and potentially about science too. Maybe from these conversations some families might become mobilised to seek out other STEM opportunities for their children." - Phil Day.

The partnership gave a much bigger weight to the shows at Catalyst. These were part of a larger event and this encouraged sign up from the local schools. A week full of activity gave momentum to the events and the impact was tremendous. This new collaboration was very worthwhile and extremely valuable to Catalyst. Project partners have already started discussions and have ambitions to run something similar next year.

Glasgow Science Centre

GSC's relationship with QuantIC, the UK Quantum Technology Hub in Quantum Enhanced Imaging has been further enhanced by their inclusion in this project.

GSC aims to remain relevant and up-to-date by showcasing the latest developments in science and technology across a range of areas such as energy, the space industry, manufacturing and AI. Our exhibition **Making the Invisible Visible** is the first stage of our new programme *Idea #59* which we are currently developing. The success of the exhibition in achieving QuantIC's overall ambition has helped develop a dynamic and positive relationship between Glasgow Science Centre and the team at QuantIC.

QuantIC have been particularly positive about the overall experience of working with GSC's Experience Design Service team: "Their input and insight has been invaluable in making QuantIC's research come alive with the public."

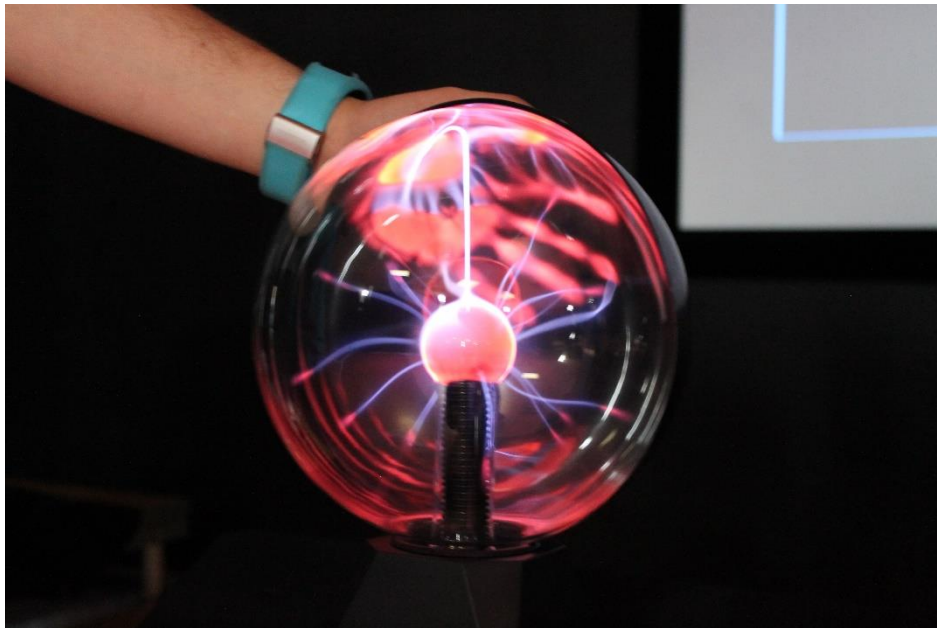
Visitor feedback has also been encouraging and dwell time at the exhibition is generally quite long, indicating that the topics being showcased are of interest to visitors, and that the interactive nature of the exhibits is attractive and stimulating to them.

The focus of the *Idea #59* exhibition and the associated programming will be to showcase emerging technologies and to inspire the next generation of engineers, scientists and innovators to get involved.

It is therefore hugely important that we continue to develop our partnerships with the researchers and industry professionals involved – and programmes like Explore Your Universe have helped us to do this.

Peter Chua and the team from QuantIC who were involved in Explore Your Universe found the experience to be useful, with Peter stating that "It was a good learning experience and I think Matt, Vincenzo and Chengzhi found it insightful and engaging, with kids younger than they were used to!"

By providing high-tech equipment and expert interaction, the QuantIC team were able to add a valuable aspect to the event which ensured a 5-star experience for our visiting schools.



Jodrell Bank Discovery Centre

The Jodrell Bank Discovery Centre's updated Explore Your Universe workshop is excellent at educating Secondary school students about the STFC funded astronomy research conducted at the Jodrell Bank Observatory, along with other global institutions such as CERN. The workshop excites and inspires students about STEM careers, as well as encouraging uptake of STEM in higher education.

Whalley Range High School was very active in this project, with more students engaged than any other school. 188 of their (all female) students experienced the EYU workshop as part of an outreach visit, and a further 226 experienced it as part of a visit to the Jodrell Bank Discovery Centre. Feedback from the students was very positive, and teachers praised the workshop for giving students the opportunity to use high quality equipment, to which they would not usually have access.

The workshop introduces the Lovell telescope, the third-largest fully-steerable telescope in the world. Through diffraction grating glasses, an infrared camera demonstration, and a plasma ball wirelessly lighting a bulb, students are introduced to the concept of the electromagnetic spectrum; the existence of radio waves, and the fact that the Lovell telescope detects these rather than visible light. Students then complete a series of team-building challenges using the laser ray boxes and lens/mirror kits, which simulate a telescope collecting EM radiation. Students then discuss and feedback what skills they used to complete the task. Answers provided often include, team-work, creative thinking, problem solving, etc. The presenter emphasises that the scientists working at Jodrell Bank use these skills every day, and if students choose to study STEM subjects, and follow a career in STEM, they will be developing these skills. In the latter part of the workshop, students learn that the work at Jodrell Bank is just part of the STFC research funded happening around the globe.

CERN is used as the second example, and the workshop concludes with a demonstration of the Van de Graaff generator and salad bowl particle accelerator.

Although not part of the official EYU evaluation, the Centre's own evaluation found that 78% of the students that experienced the outreach visit enjoyed the workshop. In addition, 83% of the same group stated they were "more likely to consider going to university". One of the teachers commented, "Engaging practical; simple but relevant."

National Space Centre

The workshops at HMP Leicester are an unusual case study, showing how a topic that might be seen as out of reach to a disengaged audience can actually be used to inspire and engage. The attendees varied widely in their educational level, from well-educated to those with minimal or no literacy, yet all engaged with the workshop. Of course, this is a slightly self-selecting group within the prison's population as they chose to attend the workshop. Those that did found it to be something "different", that it was "interesting" and "enjoyable" and that it sparked conversation and discussion. The support of the prison librarian and prison staff in general was essential to the success of the workshops, both in planning appropriate activities and in supporting the logistics of arranging the workshop. It is possible that this kind of workshop may not be replicable in all prisons as different prisons will have different security issues and protocols as per the level of security or other special provision needed for their inmates.

One of the reasons that these workshops are viewed as such a success from the point of view of the National Space Centre is that they have helped to build a relationship with HMP Leicester's prison library that has facilitated other projects, including one to allow prisoners to create content for prison radio, bringing in speakers from the UK space sector. This and other events connected to HMP Leicester have also added new dimensions to existing links with Leicester Council and organisers of local TED talk programmes.

The link with Teachfirst could also be written up as a case study, as it is the start of a continued relationship between the National Space Academy and the regional Teachfirst programme. One of the reasons why the feedback for the sessions delivered here was so glowing is that the National Space Academy's teacher training sessions are always run by current teachers whose classroom and curriculum knowledge is right up to date, and whose classroom experience adds to the value of sessions.

Observatory Science Centre

'The privilege of witnessing the delight on a child's face at the moment of comprehension with something amazing in science'.

The most memorable moment of the Explore Your Universe Phase 3 project is a small achievement of huge significance for one young child.

One of the schools visited specialised in education for children and young people who have a range of Special Educational Needs (SEN). The visit was arranged for two workshops, eleven children to engage in each workshop with supporting adults.

The children gathered in anticipation of the science workshop; however, one child was reluctant to join the group. Both the unfamiliar equipment and the introduction of an unknown adult was a little overwhelming. Thanks to the excellent professional support of the child's carer, the child remained in the classroom. The workshop commenced with dialogue asking what was light. The children responded to questions with a range of answers and alternative creative ideas. The reluctant child sat quietly and began to observe the other children, the equipment and made eye contact – the first success.

As the workshop progressed, equipment was demonstrated with explanations to support understanding, working together with the children's support team, every child was helped to make links and understand how science was all around in everyday life.

Towards the end of the workshop the child that had been so very reluctant to engage at the beginning stood up, walked up to the equipment and asked in a whisper if they could touch everything as they wanted to feel science. Without another word, each piece of equipment was explored and touched. The room was silent whilst the child investigated everything of interest, once this had been achieved; the child touched the carers hand and nodded.

Everyone in the classroom witnessed at that moment that this child had understood and made a connection with science, which represented something truly amazing.



Science Oxford

Supporting teachers through informal twilight CPD has the potential to impact a significant number of children within a single school. As part of our Explore Your Universe project, Science Oxford developed hands on activities using the EYU resources which were incorporated into our existing programme of CPD delivery.

Our CPD programme has an emphasis on working scientifically and equipping teachers with ideas and strategies that are immediately transferrable into the classroom. As a result, teachers feel empowered and confident to deliver their lessons in new and exciting ways.

A drama based activity to demonstrate the movement of the sun, the earth and the moon provided a memorable way to demonstrate these complicated relationships. In addition, a problem solving workshop to determine how light travels in straight lines was delivered which utilised equipment that schools would have readily available. Demonstrations using some of the more portable EYU kit provided additional ideas and kit is made available to schools via a kit loan scheme.

Our courses were delivered in-school and to all teaching staff, therefore influencing the school as a whole. By working with teachers in this way, and providing practical and transferable ideas for classroom activities, the potential impact on the children is far greater and more sustained than an individual visit.

Techniquest Glyndŵr

One aspect of Techniquest Glyndŵr's delivery of the project that was particularly impactful was the use of the Explore Your Universe workshop at the International Women in Engineering event. The Explore Your Universe workshop was chosen as an activity for this day to give the female pupils an insight into current scientific research being done in the UK, in order to highlight the career possibilities available to them and raise their aspirations for pursuing a career in STEM. From the feedback gathered from the female participants it appears the activity was highly successful in its aim to engage more girls with STEM subjects, as 99.5% of students who participated in the activity said it had increased their understanding of engineering, and 99% said it had raised their awareness of STEM careers. More notably, there was an overwhelming response from the students who said the activity had inspired them, and 93% of students said the event had given them the feeling that STEM careers could be for 'people like me'. Initiatives such as this are hugely important at addressing the huge gender imbalance within STEM, as the female students largely went away feeling more enthusiastic and more confident in engaging with STEM subjects. Following the Explore Your Universe session, one student said they had learnt that STEM "offers many different jobs and opportunities", while another participant said the activity had helped them "not to feel pressured by stereotypes within the field of STEM".

Techniquest

Explore your Universe workshop in Ysgol Santes Tydfil in Cymraeg.

Connor and Callum visited Ysgols Santes Tydfil to deliver the EYU workshop and the children and teachers were equally excited about the workshop and the fact that the workshop was delivered in Welsh.

A number of the children commented on their evaluation forms about the Welsh delivery:

- *"It was great that you speak Welsh."*
- *"It was cool that it was in Welsh."*
- The teacher agreed commenting *"Thank you for providing the workshop in Welsh."*

The teacher felt that the workshop content would complement future lessons and that it managed to convey tricky concepts in a way that was accessible, engaging and relevant. The pupils also commented that they would learn more about the workshop content in future lessons- showing that the teacher must have emphasised this during the workshop. It shows that the workshop was not a bolt on experience.

Pupils in Welsh medium schools are taught totally through the medium of Welsh and so their English language skills take longer to develop- this makes spelling very interesting!

Copying exactly as the children wrote in respect of best bits of the workshop:

- *"I like the Barbis her as it sticd up and it was fune"*
- *"it was reli good"*

The spelling might be a challenge but the messages are clear.

Also the children really grasped that the Galaxy is very very big and atoms are small.

The word – spelt in a variety of ways!- that was mentioned the most was fascinating.

W5

St Genevieve's High School

St. Genevieve's High School is an all-girls school in West Belfast. The school does not currently have a STEM club or a physics teacher within the school for year 13/14 classes.

Brendan Kerr, one of the teachers in St. Genevieve's High School contacted STEM Hub NI about trying to encourage the students in the school to think more about STEM opportunities. STEM Hub was aware of the Explore You Universe programme and got in touch with the Education Team at W5. Soon after applying to participate it was clear that Explore Your Universe could potentially be very effective in inspiring the girls at St. Genevieve's.

W5 visited all the Year 10 students in St. Genevieve's on 27th September 2017. Each class took part in a 50 minute Explore Your Universe workshop in which the students explored STFC's big themes of Big Telescopes, Inside Atoms, Amazing Materials and Big Data. The students were able to build their

own telescope using a metre stick, two pieces of blue-tac and two lenses as well as investigate interactions of subatomic particles with balloons and a Van de Graaff generator, as well as replicating Sir. Isaac Newton's famous experiment when he split light.

The students spent time thinking about the past, present and future with Galileo, Jocelyn Bell Burnell and the scientists working of the James Webb Space Telescope. All-in-all it was a whistle-stop tour around our Universe before consider the potential in the room for new innovation in science and technology.

The teacher in charge was so impressed he's now on the hunt for funding to secure an infrared camera for the school! Could this be the start of a STEM club in the school? W5 hopes so.



Inspiring family audiences

Each of the science centres involved has worked hard to inspire family audiences and to make people feel that science is for them and to engender a spirit of confidence in people that they can get involved and try new things. This is particularly important when running Explore Your Universe activities in communities who are remote from STEM. Below we have pulled out what each of the science centres did as part of the family engagement programme.

Aberdeen Science Centre

Over the course of the outreach project Aberdeen Science Centre was visited by two traveling STFC roadshows “Incredible Power of Light” and “Seeing the Universe in all its Light” exhibitions. While these were present in the Centre, Aberdeen Science Centre developed and delivered a family show to complement the content of each roadshow.

These shows were all delivered in the Centre, with no additional cost to visitors, to approximately 18,944 family audience members.

Dundee Science Centre

Approximately 85 people from a family audience were engaged at the Dundee Science Festival community event, aimed specifically at reaching disadvantaged families living in the surrounding area.

Dynamic Earth

Dynamic Earth’s Inspiring Young Scientists Showcase was split across a weekend and weekday in September (both a Sunday and a Monday) to provide an event accessible by both family and community group audiences, as well as Primary and Secondary schools. The Showcase was made up of a marketplace style of stalls of activities and experiences staffed by scientists and representatives of organisations from academia and industry. The event was a free experience for families and community audiences as either a destination event at the Centre, or as an experience enhancer included as a component of their day with us in the Centre. Families were free to spend as little or as long as they wished in the showcase area throughout the day. It is estimated that around 600 family engagements took place.



Winchester Science Centre

EYU equipment and expertise was used as part of a celebration of electricity at Winchester Science Centre for May half term. The repaired Van de Graaff and plasma ball formed essential parts of a wider 30-minute live show called 'High Voltage' designed to communicate the concept of electricity, its historical context and the future of wireless charging. Specific audience numbers were not counted for these shows. 44 shows were delivered in total with an estimate of between 25 and 150 attendees per show. This means in total between 1100 and 6600 people in family groups engaged with EYU resources and related concepts.

Cambridge Science Centre

A total of 970 individuals were engaged with across seven public audience sessions. These sessions were held at:

- King's Lynn Town Hall (Easter holidays, ten mini-workshops)
- Ely Cathedral (May Half-term, ten mini-workshops)
- Cambourne Science Festival (weekend, village centre venue)
- St Mary's RC Primary School, Lowestoft (summer holidays, six mini-workshops)
- Hauxton Village Primary School (weekend, fete)
- King's Lynn Arts Centre (October half-term, six mini-workshops)
- Cambridge Family Film Festival (half term)

Five of these seven were new audiences with whom Cambridge Science Centre had not previously engaged.

Catalyst Science Discovery Centre

Family visitors to Catalyst have the opportunity to participate in a Science Show as part of their visit. During this project the science shows on offer to families over weekends included the EYU Family Show running in Spring and Summer 2017 and an adapted show called 'Light fantastic' running from October 2017 to January 2018. Families enjoyed the opportunities to participate and learn about cutting edge science in these shows. A total approximate number of family audiences engaged was 470.

Observatory Science Centre

To maximise the opportunity of science engagement to family groups, the Thermal Imaging camera was used ad hoc for 'science busking' during the Astronomy Festival. Creating an environment encouraging science fun and science curiosity within family groups revealed a common learning interest, irrespective of age, gender and interests. Whilst it would be impossible to specify numbers engaged with this activity, this approach to engaging families with science fun will become embedded within the 2018 programme. For National Science Week (March 2017), a new in-house science show entitled 'Changing World' was launched. Throughout the school summer holidays, the show was presented to family groups repeated daily.

Science Oxford

Our Planetarium show at Wood Farm School was targeted at family audiences. Held during the October half term holiday the visual content was designed to appeal to young children whilst

offering interesting facts and information that would appeal to parents as well. Approximate number of family audiences engaged: 90 families

Techniquest Glyndŵr

The Explore Your Universe family show was delivered over six weekends in June and July 2017. For families visiting Techniquest Glyndŵr, admission to the live science show is included in their entry price and shows run at least twice a day. Birthday parties are also hosted in the Science Centre at weekends, and these groups have their own science show, which during this time would have been Explore Your Universe. As an addition to the kit provided, Techniquest Glyndŵr purchased a large quantity of diffraction specs so that everyone in the audience of a family show could view the spectrum, which were used in an impressive demonstration using the spectral tube box. Over the course of the six weeks, the show was delivered 22 times to family audiences, and a total of 844 people saw the Explore Your Universe family show.



Engaging communities and under-represented groups

Dundee Science Centre

Approximate 125 people from hard-to-reach community audiences were engaged at the Dundee Science Festival community event. It was held in an area of high deprivation, so all of the families/groups/individuals who attended fall within this grouping. It was held out of Dundee Science Centre to ensure that local people would be able to access it more easily, instead running in their local community centre. The venue also aimed to alleviate other barriers to engagement from local communities and under-represented groups such as confidence, finance, etc. by holding it somewhere that made them feel comfortable and was recognisable. The event was also free-of-charge.

Dynamic Earth

Our Inspiring Young Scientists Showcase was split across a weekend and weekday in September (a Sunday and a Monday) to provide an event accessible for both family and community group audiences, as well as Primary and Secondary schools. On the Monday of the event, we provided schools with an hour-long time slot to engage with the showcase. For this we had the assistance and facilitation of our Learning Officers. The Showcase was made up of a marketplace style of stalls where activities and experiences were staffed by scientists and representatives of organisations from academia and industry. Access to the showcase was free for school pupils and Dynamic Earth fully subsidised the cost of transport for each school group that attended. Of the 500 school pupils who attended, >60% were from schools with a Scottish Index of Multiple Deprivation (SIMD) index of 25% or greater. **Approximate number of community/under-represented audiences engaged: 307 from harder to access schools.**

Winchester Science Centre

A key part of the original proposal was working with schools that had been targeted on the basis that they had high numbers of students on receipt of free school meals (FSM) and low post-16 uptake of STEM subjects. Four schools ultimately received visits, three of which fulfilled the above criteria:

Cantell School has a higher than average number of students in receipt of FSM (21.4 %) and the proportion of students from minority ethnic groups is 'significantly' above the national average for secondary schools (Ofsted 2017). It is in a POLAR quintile 5 region which gives a false impression of progression to higher education institutions, this is likely due to its proximity to the University of Southampton.

Winton Community Academy has a higher than average number of students in receipt of FSM (21.1 %) and is in a POLAR quintile 3 region, an area with moderate participation with higher education institutions

Woodlands Community College has a higher than average number of students in receipt of FSM (28.1 %) and is in a POLAR quintile 1 region, an area with the lowest participation with higher education institutions.

In total 71 % of the students engaged as part of EYU phase 3 were from targeted schools and approximately 16.9 % of all students were in receipt of free school meals.

Catalyst Science Discovery Centre

Catalyst Science Discovery Centre runs very successful sleepover events within their venue. Staff at Catalyst identified these as perfect opportunities to engage community groups with the EYU resources. Each group sleeping over were offered a morning workshop and science show. Over the course of this funded project, sleepover groups participated in either the EYU Show or an adapted 'Light Fantastic' show. The new version of light show incorporated many of the EYU resources including the Infra-red camera, the UV lamp, the white light and prism, the plasma ball and the gas spectrum tubes. The community groups sleeping over range from the Girls Brigade to the Beavers, and each community group have very little access or facilities to explore science topics themselves.

Approximate number of community audiences engaged: 705

Glasgow Science Centre

As part of this project, Glasgow Science Centre had hoped to engage with schools in areas that can be challenging to reach. We had proposed that we would engage with schools in North Ayrshire, Renfrewshire, North Lanarkshire, West Dunbartonshire and Glasgow. After opening this project up to local authorities and schools in each of these areas, we were successful in obtaining bookings from schools in North Ayrshire, Renfrewshire and Glasgow. All of the schools we booked to take part in Explore Your Universe were from the top 20% of the Scottish Index of Multiple Deprivation.

Jodrell Bank Discovery Centre

All schools engaged in this project were classed as disadvantaged by having a high proportion of students eligible for free school meals. Government data lists the percentage of students eligible for free school meals for each school. Therefore, using this data, it has been possible to calculate the above estimate that around 1,040 students engaged during this project are from a disadvantaged background (i.e. eligible for free school meals). This calculation assumes that the groups engaged are representative of their school overall. **Community audiences engaged: 1,040.**

National Space Centre

The National Space Centre took Explore Your Universe into the Prison in Leicester and worked with inmates for the programme. The type of engagement was necessarily deeper than in most community events and the evaluation shows how engaged the prisoners were. Overall 18 prisoners were engaged with Explore Your Universe.

Observatory Science Centre

The Observatory Science Centre has become a Primary source for home-educators in science learning. To take the opportunity to deliver the Explore Your Universe Phase 3 to the home-educating community, groups were invited to a dedicated science learning open day.

Home-educated children were encouraged to engage with science demonstrations to support their individual learning objectives and targets. Access to the Explore Your Universe equipment provided the opportunity to ask questions and increase levels of understanding.

Whilst home-educators voluntarily join specific groups as a platform for education opportunities, there is not a singular database in the public domain to access. Relationships have been established with local group organisers, individuals and enquiries via the Observatory Science Centres website.



Social media, specifically Twitter and Facebook has been used to promote science learning open-days specifically for home-educating groups.

Since the Explore Your Universe Project Phase 1, the Explore Your Universe equipment has proved of great value, continuing the legacy of the project for the future.

Science Oxford

The locations of the planetarium Show and the Space Camp were deliberately chosen to target audiences from Rose Hill and Wood Farm, which are both regions recognised by Oxford City Council as “areas of regeneration” with multiple indices of deprivation. They are also areas which do not regularly engage with outreach opportunities available locally and hence the decision to host events in the locations themselves to encourage participation from the local area.

Science Oxford has good links with schools and community groups in these areas which enabled us to target the promotion of these events with the required audiences. **Approximate number of community audiences engaged: 125 children and their families.**

Techniquet Glyndŵr

Techniquet Glyndŵr engaged with several community groups with the Explore Your Universe family show. In October 2017 families who are members of the Wrexham Branch of the National Autistic Society came into the Science Centre to watch the public show, and took part in additional hands-on elements from the schools workshop including a closer look at the thermal imaging camera, spectroscopes, Ferro fluids and meteorites.

A large group of families whose children are home educated also visited the centre, a total of 45 children and 25 adults took part in the public show as well as interacting with the equipment from the school’s workshops. Home educated children are often largely under-represented in STEM engagement and the families were very grateful of the opportunity to engage with equipment that would be otherwise inaccessible to them.

Techniquet Glyndŵr also hosts local Guiding and Scouting groups quite frequently, and two groups of Girl Guides, aged 10 to 15, made evening visits to the Centre in November 2017. These visits included watching the Explore Your Universe family show, as well as taking part in some of the hands-on activities from the school’s workshop. The activities enabled several of the Guides to achieve their Science badge.

Gender reach: The male and female split

Overall, the general split between males and females was roughly 50:50. No Science Centres reported finding it difficult in any way to engage either gender in their EYU activities.



Aberdeen Science Centre - all school groups who were visited as part of the funded EYU outreach are estimated to be 50:50 male/female. None of the schools are gender specific and no groups or classes were divided by gender.

Dundee Science Centre - all events run during this project had an even gender split. All events also were delivered by an even mix of male and female staff, to avoid any perceived bias and to encourage wider engagement.

Dynamic Earth - based on our on-going evaluation of family visitor segmentation, we estimate that our visitors were approximately 50:50 male/female split across the family day of the showcase. The school's day was not attended by any single-sex school; therefore, we anticipate the split on the school's day would also be close to 50:50.

Winchester Science Centre - all four schools engaged with the programme were mixed, however data gathered from Ofsted suggests that each school was slightly male dominated with the approximate % of female identifying students being 44.6 %.

Cambridge Science Centre - the overall gender split across all events (including the 35 groups CSC delivered to in schools) is assessed to have been 50:50 male and female. 28 of the 35 school outreach visit groups were mixed boys and girls groups assessed to be approximately a 50:50 split. A further six groups had a gender bias of no more than 65:35 toward either gender. One Year 11 group was all boys (n=12).

Catalyst Science Discovery Centre - Catalyst work hard to ensure opportunities are available for all within their Centre, whether that be adapting for special needs, or amending for varying ages. All community groups, family members and school pupils are offered EYU interaction regardless of their gender, age or needs. Experienced presenters are able to adapt shows to ensure suitability for all.

Glasgow Science Centre - from the evaluation carried out as part of this project we have estimated that 47% of pupils who visited identify as female, and 53% identify as male.

Jodrell Bank Discovery Centre

	Estimated number	Estimated percentage
Girls	1289	59.6%
Boys	875	40.4%

During the project all engaged schools were mixed, with the exception of Whalley Range (a girls' school). The above estimates assume a 50:50 gender split for all mixed schools engaged during the project.

National Space Centre - all attendees at the HMP Leicester workshops were male as it is a prison for men.

Of the teachers attending the CPD sessions at the National Space Centre the majority were female.

Observatory Science Centre - throughout the Explore Your Universe Phase 3 project, the gender reach of the 1,059 children engaged with in the Primary schools equated to proportionately 50% girls and 50% boys. The response to the workshops by each gender has proved to have a commonality, consistently displayed across all the primary schools engaged with.

In general, girls were initially slightly more cautious to engage in dialogue, however, their questions as the workshops progressed became more specific and responses more verbally detailed. The girls' vocabulary reflected an emotional reaction to the demonstrations with the use of words such as 'exciting, funny, amazing, feel good'. An interesting observation, common through all the schools visited, was a perception by the girls that science is a subject that boys are better at. This preconceived idea of gender stereotyping may have been responsible for the girls' initial hesitancy in engaging with the workshop. Sadly, a couple of the female teachers also had this misconception; one teacher suggested that girls should wear pink lab coats.

The boys exhibited a high level of excitement by merely seeing the equipment set out, even before the workshops commenced. Whichever year group or ability level, the boys consistently expressed excitement and anticipation at what was going to happen next in the workshops by a more physical reaction. Waving hands, shouting out and perceivable impatience was expressed.

Dialogue was punctuated with many 'cools, brilliant and amazing'. The boys generally demonstrated a much greater confidence with engaging with the equipment and wanting to take a 'risk'!

Without exception, by the end of the workshop, all children, boys and girls, were able to understand that science is relevant to everyone.

Science Oxford - no specific details of gender were collected for the events, but with space being a universally popular topic, we did not notice any specific gender bias and therefore assume the split to be approximately 50:50

Techniquet Glyndŵr - Techniquet Glyndŵr is committed to ensuring that all activities are gender neutral and that all staff are fully trained in Gender Equality Awareness, and the development and delivery of the Explore Your Universe activities were no exception. The gender split of school pupils

engaged with, both in Centre through the Bursary scheme and on outreach visits, was very even, with 53% of the audience being female and 47% male. Similarly, with families and community groups, it is estimated that the split was around 50:50 as there was no noticeable imbalance in the audiences reported. The only exception was for specialist groups and events that are aimed solely at female participants. The Guiding community groups were all female, and the International Women in Engineering Day was exclusively aimed at female students, with a view to addressing the huge gender imbalance in Engineering and STEM related careers in general.

As previously mentioned, all Techniquest Glyndŵr staff receive Gender Equality training, and as such all staff delivering any workshop or show have an awareness of how to achieve gender balance throughout their engagement, and how to use appropriate language which will not exclude or alienate any members of their audience, to ensure that gender does not become a barrier to engaging with STEM subjects.

Techniquest - the workshop was delivered to a total of 1287 pupils of which 619 were girls and 668 were boys.

W5 - the majority of the schools engaged through Explore Your Universe phase 3 have been mixed gender schools and in each case the groups have been assessed to have a ratio 50:50 (girls: boys). St. Genevieve's High School is a school for girls with 118 students participating in the programme and Ashfield Boys' High School is a school for boys with 50 students participating. In total this meant that out of the 927 students engaged, there were an assumed number of 498 girls and 429 boys participating.

There were very few gender related barriers when working with mixed schools although the language used in the workshop was specifically written to deal with gender bias in STEM against girls. Jocelyn Bell Burnell was specifically chosen to address this issue by incorporating her story as a positive female role model in physics without reinforcing the problem of mentioning negative stereotyping.

Developing new relationships, partnerships and networks

ASDC designed this programme to create legacy and a major part of this is supporting and enabling science centres to develop new partnerships and relationships that will continue into the future. These relationships are particularly important as they assist the centres in reaching wider audiences, especially with families living in areas that are high on the indices of multiple deprivation. They are also vital for knowledge exchange and for keeping the science up to date. Below is a list of many of the new relationships created in this programme that will have legacy for the future.

Aberdeen Science Centre identified Moray as an area that had limited opportunity to engage with STEM activities. The EYU funding allowed Aberdeen Science Centre to visit this area and develop a relationship with the community. Engagement with the Moray schools through the EYU programme has 'broken the ice' with these schools. Aberdeen Science Centre now have an established relationship with staff, management and pupils at these schools, paving the way for further engagement in the future. Senior Management at the schools visited all expressed an interest in developing closer links and beginning an annual outreach programme.

Dundee Science Centre continued to develop relationships with external partners that were brought in for their community event. The project allowed Dundee Science Centre to improve its links with other science centres through the CERN visit and the training academy in Edinburgh. The training academy in particular helped to inspire closer links between the Scottish science centres, especially at officer level, as the officers have continued to meet up since then to share experience and training.

Dynamic Earth - Following on from the most recent EYU Training Academy, there has been increased dialogue and communication between development level staff across the Scottish Science Centre network surrounding continuous improvement culture, collaboration opportunities and sharing best practice.

Cambridge Science Centre has developed a new relationship with the LinHigher³ partnership, which operates alongside Bishop Grosseteste University in Lincoln and aims to increase the uptake in tertiary education in Lincolnshire. This is a new area for Cambridge Science Centre which creates opportunities to visit other schools in the area pending suitable funding. Cambridge Science Centre has also developed a relationship with Lowestoft Rising and the Kirkley People's Forum. CSC has worked with them before, but this time the roadshow was at a new school (for CSC) with ten new Primary Schools engaged.

Catalyst Science Discovery Centre has been operational for thirty years and has built great relationships with many schools. Most of the schools Catalyst engaged with over the course of the EYU phase 3 project had previously visited Catalyst. This project strengthened these existing relationships, showcasing to schools the opportunities on offer and the up-to-date scientific knowledge of the team. This project also gave a new shape to some of these relationships by, for instance, introducing and funding outreach: something that is not part of the current education programme. This meant schools became aware of new opportunities at Catalyst, and Catalyst staff

³ <https://linchigher.co.uk/>

were able to experience the wider reach that outreach might offer. New relationships were created with the New Horizons Centre for Alternative Provision as part of this project. Their first impressions were excellent: due to the quality of the programme funded by EYU, they have had the opportunity to see how programmes can be adapted for their needs. Catalyst hope they will become regular visitors. Another new relationship was formed with the Head of Science at Ladybridge High School. The school had visited Catalyst many years ago but the Head of Science hadn't visited in her new role. Attending a careers event at Catalyst introduced the Ladybridge Science team to the range of opportunities available. With ever changing school staff, it is important to appreciate that maintaining relationships is as vital to Catalyst as developing new ones.

Glasgow Science Centre engaged with a number of institutions including the University of Glasgow, University of Strathclyde and the Royal Society for Chemistry. Explore Your Universe Phase 3 allowed us to further these existing partnerships, in particular with the QuantIC team at University of Glasgow. We worked closely with Peter Chua who is the Public Engagement and Communications Officer for Quantic who was very excited to be involved in our Explore Your Universe events. In addition, Glasgow Science Centre worked with Olivia Johnson of STFC who circulated events to contacts at the Royal Observatory of Edinburgh and the UK Astronomy Technology Centre, leading to what is hoped will be an ongoing partnership.

Jodrell Bank Discovery Centre - as a result of this project, some schools experienced their first engagement with Jodrell Bank Discovery Centre; either a trip to the Centre, or receiving an outreach visit. Examples include Maghull High School, Wigan UTC, Gateacre School, St Anne's Heaton Chapel and Harrop Fold School. It is hoped that these schools will continue to book engagements with us in the future.

National Space Centre - the first new relationship developed has been Teachfirst in the East Midlands region, with the National Space Centre and National Space Academy looking into ways to continue this relationship in future, either by supporting existing Teachfirst schemes such as their summer projects for teachers or by sharing information with the Teachfirst network about opportunities for schools and teachers to engage with either the Centre or the Academy. Through the work of the Academy there may be the possibility of developing this connection in other locations in the UK in future as well if the East Midlands relationship continues. The second relationship that is continuing is with HMP Leicester. The prison library was successful in a bid to the UK Space Agency to pay for the travel expenses of guest speakers from the space sector to attend a further workshop, facilitated by Andy McMurray of the National Space Academy, as part of an event designed to inspire prisoners to develop content for the prison radio programme. The event was hugely successful and the resulting programmes may be shared on the national prison radio network. In light of this programme and the success of the Explore Your Universe workshops, HMP Leicester and the National Space Centre/National Space Academy will be looking for further opportunities to bring the inspirational topic of space science to those that wish to engage within the prison through the prison library programme. This may be dependent on whether any appropriate sources are found, as the prison population is very much outside the target demographic for the National Space Academy's main programmes.

Observatory Science Centre - two of the schools selected for the project have subsequently booked the Observatory Science Centre planetarium. Re-establishing links with these schools has proved to be an absolute success and an opportunity to build on further ventures. Opportunities for the home-

education communities have become embedded into scheduling for the future in the form of more specific home-education science learning days. A database of home-educators has now been established and is rapidly expanding to a wider geographical reach.

Science Oxford - Wood Farm School was a new venue for us for family activities. The relationship established with the school and the organisation that manages their lettings was therefore a new relationship that was established through this programme. Following the success of the event we would be keen to use this venue again in the future. Delivering two of the events in partnership with STFC at Rutherford Appleton Laboratory helped to further strengthen the already beneficial relationship that exists between our organisations.

Participation in this project has allowed **Techniquist Glyndŵr** to strengthen their relationship with Glyndŵr University, by enabling the two organisations to work in partnership in delivering the two careers events. Relationships with local Home Educator groups has also been strengthened by providing them with engaging and relevant science through their participation in the Explore Your Universe activities.

Techniquist - schools were selected because they were not regular visitors to Techniquist or did not book outreach. It is hoped that by experiencing this exciting and stimulating EYU workshop that the schools will realise the benefit of working with Techniquist to enrich and enhance the STEM curriculum.

There have not been any new relationships developed by **W5** as a result of participating in EYU Phase 3. This is mainly because there are limited facilities in Northern Ireland directly related to the work of the STFC. Strong partnerships were created during EYU Phase 2 and have continued on since then. Academic partners like Queen's University Belfast Astrophysics Research Centre and Armagh Planetarium/ Observatory have been invited to support several events since Phase 2. Critical industry partners like BOC also have a good working relationship with W5. W5 is called upon annually by BOC to support their school's engagement programme in return.

Number of Science Centre staff trained for Explore Your Universe phase 3

Between the 14 delivery partners there were approximately 123 staff members at science centres who were directly trained on and/or delivered Explore Your Universe activities. ASDC estimate that the actual number is higher than 123 over the Phase 3 delivery period as floor staff and visitor staff at each of the Centres will have indirectly been involved in the programme, whether that be by using aspects of the kit or using STFC themes and subject areas in other shows and workshops.

Marketing and Social Media Engagement by partners

Aberdeen

As this project aimed to engage schools in an outreach project we did not utilise social media and other marketing tools were not required. All communication was directly with the school staff.

Dundee

The 'Out of this World!' community event involved the use of tailored marketing aimed specifically at reaching local audiences. Based upon consultation with community centre managers in previous events DSC has found that it is more effective to use methods like specific community centre posters to promote the event to the local audience. This was delivered as part of the wider marketing strategy of Dundee Science Festival 2017 which promoted all events including the EYU event.

The school events were promoted to qualifying schools by email and phone calls. The STEM Learning Team often finds it difficult to get its message past school administrators to the right teachers. Personal communication with known teachers is always much more successful, but that is not normally possible when trying to engage new schools. Local authority Quality Improvement Officers / Education Support Officers can be useful to help spread the word. A combination of these methods allowed the team to secure the bookings needed for this project.

Dynamic Earth

Our Marketing and Communications Team took steps to ensure the event was marketed well:

- The showcase had a dedicated page on the Dynamic Earth website and was cross linked from the Schools, Family Learning and Community pages to ensure ease of access.
- Two e-newsletters were distributed to our family contacts database with more than 7,000 members advertising the showcase.
- Multiple e-newsletters were distributed to our school's contacts database with more than 12,000 members advertising the showcase.
- The Careers Showcase received a dedicated two-page marketing spread in our 2017-18 Learning Programme sent to every school in Scotland.
- Our Group Bookings Agents, Science Engagement Officer and Community Learning and Development Officer provided personalised invitations to under-represented audiences either through face to face, email or telephone communication.
- Posters and flyers were distributed to local community projects to encourage attendance from harder to reach audiences.
- The Showcase was promoted by representatives from the Dynamic Earth Board of Trustees at relevant events they attended

The event was widely promoted on Dynamic Earth's Social Media accounts by Dynamic Earth and contributing exhibitors including Twitter (@OurDynamicEarth and @Learn at Dynamic – with a combined following of > 8,500 people), Facebook (with nearly 14,00 page likes) and Instagram (>1,350 followers). In addition, our PR agency provided blog coverage of the event.

Winchester

EYU phase three was advertised in teacher and STEM ambassador newsletters to approximately 3,300 and 2,600 people respectively.

Cambridge

CSC activities attracted coverage in 16 online articles, seven of which were reported content from the websites of local newspapers.

Catalyst

Explore Your Universe was marketed in a variety of ways at Catalyst. The family events in the summer holidays were advertised on printed posters and distributed to over 200 Tourist Information Centres, Holiday Accommodation Providers, Libraries and Leisure Centres. These public activities were promoted on Catalyst's social media, of which Facebook has over 2,200 followers. The events were further promoted on the Favourite Days Out in Cheshire media channels as Catalyst is part of this consortium. Favourite Days Out Facebook page has 11.5k likes, of which 83% are women, 75% of whom are aged between 25 and 54.

The Explore Your Universe schools workshop was advertised on the new Catalyst website launched in September 2017 and on the annual Education Programme, distributed by post to approximately 5,000 teachers in the North West.

In the Autumn term, Catalyst advertised the Explore Your Universe Outreach show to 51 local Primary schools via email. Catalyst also took part in a project in conjunction with Daresbury Labs an STFC funded organisation and delivered Explore Your Universe Shows to local Primary schools. This project was promoted jointly by Catalyst and STFC. STFC regularly tweeted throughout Space Week and @STFC_Matters has 15,900 followers.

Details about the Explore Your Universe project were included in the Catalyst Annual Newsletter which was distributed widely to Trustees, Patrons, Friends, Sponsors and Schools.

Glasgow Science Centre

Our strategy for filling this event was to directly contact schools and local authorities to identify the schools within the top 20% of the SIMD index. We therefore decided not to include any marketing in literature sent out to schools in advance, which we felt would have confused the matter.

On the days of the events, GSC as a company had social media blackout we had planned as part of our new brand launch on Thursday 14th September. Throughout this we didn't have any social media presence in order to increase anticipation for our brand launch.

However, after this event passed and we had opportunity to add to our social media activity, GSC posted to Twitter and Facebook to share information about our Explore Your Universe activities.

These are key channels for us with over 34k page likes on Facebook and 14.9k on Twitter ensuring wide dissemination of our posts and tweets respectively.

We also had posts from All Saints Secondary School on Twitter who shared their excitement and enthusiasm for their chance to visit us. This was followed up by a Twitter post from ReallySmallScience who had a fantastic time throughout the event creating polymer bouncy balls.

Jodrell Bank Discovery Centre

Members of staff were encouraged to tweet their involvement in EYU activities, where possible. This is made more difficult for activities at the Centre, as Jodrell Bank Discovery Centre is in a radio quiet zone where mobile devices cannot be used. Below is a tweet from Jamie Sloan (Education Manager) on an outreach visit to Gateacre School. The tweet was viewed 716 times.

National Space Centre

Marketing and social media were not used to promote the HMP Leicester workshops for obvious reasons, the workshops were advertised through the prison library.

The sessions at the Teachfirst Saturday Conference were advertised to Teachfirst trainees through regional newsletters.

The twilight session at the National Space Centre was advertised directly to teachers in Leicestershire through an email marketing campaign and by direct emails from the teachers within the Academy's core team

Science Oxford

All the events delivered as part of the EYU project were advertised through our website and usual promotional channels. In addition, we worked with partners in the targeted areas of deprivation to ensure the information was received by the required audience.

Our Space Camp in Rose Hill appeared in the local community newsletter as well as receiving press coverage by the Oxford Mail.

All events were covered through our social media including Twitter (12,000 followers) and Facebook (2,500 followers)

Techniquet Glyndŵr

Between the 5th and 20th of June 2017, Techniquet Glyndŵr strongly promoted the 'After Hours' event using social media, as well as listing the event on websites for the Festival of Learning and Adult Learners' Week. The event was also listed on Eventbrite, and details were emailed to Techniquet Glyndŵr's mailing list. Posters and flyers were also created to advertise this event, and were distributed around Wrexham town centre.

From 5th June to 14th July 2017, the Explore Your Universe family show was advertised on the Techniquet Glyndŵr website, as well as through their social media channels, to promote the weekends that the family show was running in the Centre.

Live tweets and Facebook posts were made on 23rd June to promote the Explore Your Universe activity being undertaken by the female students at the International Women in Engineering Event, which were shared by other contributors to the day and the schools involved.

Between 27th September and 1st October, there was promotion on social media for the family event for the Wrexham branch of the National Autistic Society, who also advertised the event themselves using posters produced by Techniquet Glyndŵr.

Social media was also used to promote the Explore Your Universe activities that local home educator families took part in in November, and Jaclyn Bell's visit to the Centre to see the Explore Your Universe school workshop in action was also used to promote the project on social media.

Techniquet

Techniquet tweeted prior to each delivery stating that EYU will be visiting the schools.

W5

W5 utilised social media platforms and website to promote our involvement with the Explore Your Universe programme W5 website has an average of 26,000 monthly 'users' and an average of 38,000

monthly 'sessions'. W5 social media: Facebook 'Likes' – 29,130 Twitter 'Followers' (W5atodyssey, W5Education & STEMW5) – 4,200".

This programme differed slightly from other funded programmes that W5 has been involved in because of the very specific criteria for participation and limited number of participants. It was felt early on in the development process that it should not be advertised publically as a targeted mailshot would be much more efficient.

W5's social media interactions with regard to this programme were mainly to promote the work of STFC and the wider Explore Your Universe programme rather than pushing teachers to apply for participation.