UK SPACE AGENCY

Impact Assessment:

Principia Education Campaign

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Introduction

Tim Peake's six-month Principia mission saw him living, working and carrying out scientific experiments on the International Space Station between December 2015 and June 2016.

The UK Space Agency wanted to use the interest in Tim's mission to change how young people thought about space and engage the next generation of scientists and engineers.

With the government supporting Tim's mission as a European Space Agency astronaut, this was a whole new opportunity to increase the number of young people engaging with science across the UK. But we wanted to go further. This was also a chance to expand interest beyond the physical sciences into medicine, biology, health, diet, fitness, literacy and beyond.

We helped tell Tim's story to the public, from his training to his preparation for flight and his time in space.

Our education programme used this story to capture the excitement of human spaceflight, both in and out of the classroom. It was packed with UK-wide activities and projects to be used by teachers, home educators, extra-curricular groups, families and anyone else looking to inspire future scientists.

In this summary, we'll focus on the incredible educational impact that Tim's mission had – and continues to have – on a wide range of children and young people all over the UK.

'Principia was a unique opportunity to engage a young audience in science and human spaceflight. This was only possible thanks to the efforts of the UK Space Agency, ESA and hundreds of volunteers who embraced the potential of this mission through a wide range of educational projects.'

Tim Peake

You can read the full report of Tim's mission, 'A report on the impact of the UK Space Agency's Principia Communications and Education Programmes', at GOV.UK

Our mission

We were looking to benefit the UK space sector and the wider economy by:

- encouraging interest and uptake in STEM subjects and careers in the space sector
- increasing the public's knowledge of the space sector and the benefits it brings

To do this we had to give as many people as possible the chance to be part of Tim's mission. We had to reach those not usually interested in science and space as well as students considering their careers or subject options. We needed to join with partners to access audiences through as many different subject areas as possible, including those not usually linked to space.

So, we planned to:

- create a national programme reaching every corner of the UK
- support not just traditional STEM subjects, but wider subjects such as sports, health, art and literacy
- inspire interest in careers in science and technology
- reach as many different types of young people as possible, from the underserved to the gifted, from science fans to creative types
- work in and out of the classroom, with informal learning to help children and families understand that science is useful for everyone

We had around **£3 million** to reach **480,000 people** over 3 years. We exceeded this thanks to the phenomenal efforts from our partners, the European Space Agency and Tim himself.

The Principia Education Programme

£3 million budget

34 different projects funded or supported by UK Space Agency

Over **1.6 million** young people engaged in one or more UK Space Agency-funded activity by March 2017

Activities covered **every region of the UK**, representing urban centres, towns and cities, rural villages and small hamlets

Over **2 million** young people now estimated to have participated by the start of 2018 – and still growing

1 in 3 UK schools took part in at least one activity

40% of activities lasted for weeks or months to keep children engaged long-term

Covered both **formal and informal education**

The Principia education programme

The Principia education programme was made up of 34 different projects of many scopes and sizes. They were united by our mission to create a national programme reaching different types of young people from every corner of the UK.

The large portfolio of projects allowed us to take some risks. Most of the Principia education projects were successful, and some projects far exceeded their expectations and targets. While some projects didn't reach their target numbers, they still made a big difference to the individual children who experienced them.

You can find more detail about every project in the full report on **GOV.UK**

NATIONAL HIGHLIGHTS

There were three standout projects designed for formal education.

We partnered with the Royal Horticultural Society on the Rocket Science experiment, in which young people compared the growth of rocket seeds that had been to space with seeds that remained on Earth. Holding in their hands something that had actually been into space and applying scientific processes and skills in a national experiment was a truly unique experience for teachers and students alike.

Over 600,000 young people took part in the Rocket Science seed experiment

"I learnt from Rocket Science about space science and gardening. It made me feel accomplished and I felt really focused when we were planting the rocket."

9-year-old talking about Rocket Science

In the Amateur Radio on the ISS (ARISS) project, 10 schools won a competition to speak to Tim Peake on the ISS using ham radio. Students got to ask questions directly to Tim, and his passionate responses – live from space – captured the imaginations of everyone who participated. Feedback from the schools shows the experience had a lasting impact on the children, and in some cases transformed the number of pupils choosing STEM subjects for their A levels.

"The contact made with Tim Peake on the ISS from Sandringham School in 2016 has had a significant and lasting effect on the attitudes and interest of young people in STEM related subjects."

Alan Grey, Headteacher, Sandringham School, which took part in the ARISS experiment

"We have seen a dramatic increase in the number of girls registering interest in A level physics. When asked why they wanted to study physics, girls and parents alike quoted that the initial interest came following the ARISS event where they made the live radio contact with Tim Peake. They stated that it was 'nothing short of inspirational'."

Carol Black, The Royal Masonic School for Girls, which took part in the ARISS experiment

Children participating in the Principia Space Diary project created their own book as they followed Tim's adventures. The project was so well-received in its first year that further funding was awarded to reach more children and build a legacy beyond the Principia mission.

Over 95,000 students have taken part so far.

Students were genuinely excited about the project, taking their diaries home and talking to their parents about the work. Educators plan to continue the space diary project into the future with other year groups and on other space topics.

"The girls thoroughly loved doing the space diary [...] The eldest has now decided she wants to be a flight engineer on the International Space Station when she's a 'proper grown up'."

Feedback on the Principia Space Diary project

The Tim Peake Primary Project run by the Space Education Office (ESERO-UK) included space activities as well as professional support and development for teachers. It ran over two academic years and the evaluation found that it had 'directly increased pupils' enjoyment and engagement in science, numeracy and literacy [and] attainment in science'. A year later, 97% of teachers responding to the impact survey felt that pupils' engagement had increased as a result of the project and 75% felt that it had increased pupils' confidence.

As well as motivating children to new achievements, it 'increased teachers' confidence in teaching space-related topics and using space as a cross-curricular context for teaching', equipping them with confidence to teach these subjects to their future pupils.

Destination Space, run by the Association for Science and Discovery Centres, brought together a series of informal family shows, workshops and events to help reach children and their families outside the classroom. The shows aimed to demonstrate that science isn't just for school but is relevant to their lives and something they too could do for a living. 914,646 children and adults took part, half of whom reported that it made them more interested in pursuing science options in the future.

"It showed me that there are lots of jobs to do with science, ones that would have amazing experiences and unforgettable things."

12-year-old talking about Destination Space

Enjoyment levels were the same regardless of gender or background. It cut through to groups who are underrepresented in STEM, reaching a higher proportion of students from deprived areas, and slightly more girls than boys. Destination Space continues to provide space activities to audiences in 20 science and discovery centres. It has engaged over a million more people up to January 2018, bringing the total for this project to more than 2 million people.

The Cosmic Classroom in-flight call reached over 480,000 people via video streaming through TES Global's school network.

LOCAL HIGHLIGHTS

Large-scale national projects providing the bedrock of the campaign were boosted by local projects across the UK. Team Tim's science shows for early primary, STARS' talks by space experts, Speak to Peake's Radio Wiltshire competition and the Aberdeen Science Centre Exhibit all had bigger audiences than expected. STARS reported that students continued to talk about the things they had learnt for days afterwards, and Team Tim reported that the statement 'we have been inspired with science' scored an average of 4.9 out of 5 from the students.

71% of visitors to the Aberdeen Science Centre Exhibit left feeling more confident about science

Planetarium clips were provided to local organisations by the British Association of Planetaria. 71 facilities downloaded the clips, which have been seen by over 220,000 people. 70% of the audience were primary school children and 11% were secondary school children. Within these audiences, there were proportionally more pupils eligible for free school meals and a higher proportion of pupils whose first language is not English than the national average.

ONLINE

Our mission extended online as well as in person. One Giant Read, Mission Starlight, and Adventures in Space and Tim were delivered online, and each one met their targets. The Royal Society of Chemistry, who ran Mission Starlight, reported that it was their most successful experiment to date, reaching more participants in the first four months than any previous experiment had in a year.

The Astro Science Challenge and I'm an Astronaut, Get Me Out of Here! also used online portals to get children's attention. The Astro Science Challenge encouraged young people to consider science as a future career path: when asked if they would like to be a scientist when they are older, 94% of their sample answered 'yes' or 'maybe' compared to 76% beforehand. The biggest shift in attitude was seen in girls. I'm an Astronaut, Get Me Out of Here! found that participating in a session improved students' attitudes towards science, especially among those who were less interested in science jobs before taking part.

MISSION X

NASA has led the international Mission X Train Like an Astronaut project since 2010, with an annual challenge to schools for eight weeks each January. It uses astronaut training to encourage 8 to 12-year-olds to take part in fitness activities and learn about diet and the underlying science. It was a natural fit for Tim's mission, and the extra promotion trebled the number of participants in the UK to 35,000 with the same annual budget. Schools have taken ownership by running activities alongside it, from weekends of community activities to art and design, music and writing projects.

Mission X trebled its number of UK participants at no extra cost

The Space to Earth Challenge built on the heritage of Mission X and extended the fitness-led programme from primary to secondary schools with physical activity challenges. It had excellent support from the Triathlon Trust and inspirational ambassadors such as World Paratriathlon Champion Lauren Steadman.

The UK Space Agency also promoted the European Space Agency education project Zero Robotics, but did not contribute financially. Three UK teams participated in 2015 to 2016, compared to the usual none or one.

TEACHING RESOURCES

Teaching resources created throughout the programme are still being used by various projects.

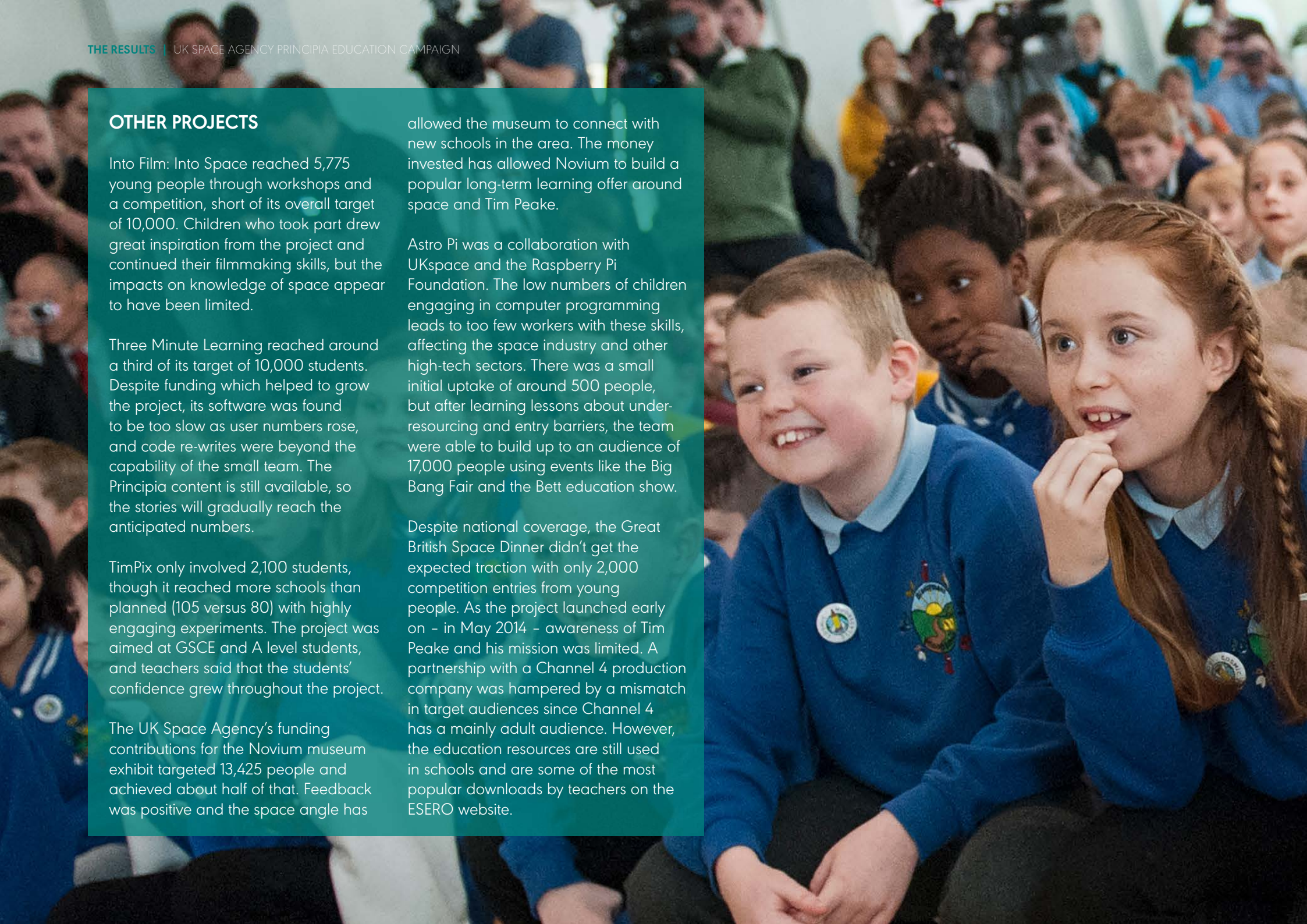
Earth Observation Detective paired online teaching resources with a competition, both based on astronaut photographs and satellite images of the earth.

1,500 teachers helped around 44,000 students to investigate the environment using maths, science, geography and computing.

Around 1,000 students entered the competition to win a photograph taken especially for them from the International Space Station.

The Astronaut Handbook and Marvin and Milo postcards were designed to be distributed to children and were handed out at various events. The Astronaut Handbook, designed to develop literacy, especially among young boys, was supported by a special abridged version and was packed full of educational content. Informal feedback from staff shows these projects were well received, and the astronaut handbooks were seen as a valuable handout.

Biorock and Royal Institution Christmas Lectures provided education resources to teachers and beat their audience targets. Astro Academy Principia comprises teacher guides and student resources, which are at the core of National Space Academy delivery for students and teacher training in the UK and overseas.



OTHER PROJECTS

Into Film: Into Space reached 5,775 young people through workshops and a competition, short of its overall target of 10,000. Children who took part drew great inspiration from the project and continued their filmmaking skills, but the impacts on knowledge of space appear to have been limited.

Three Minute Learning reached around a third of its target of 10,000 students. Despite funding which helped to grow the project, its software was found to be too slow as user numbers rose, and code re-writes were beyond the capability of the small team. The Principia content is still available, so the stories will gradually reach the anticipated numbers.

TimPix only involved 2,100 students, though it reached more schools than planned (105 versus 80) with highly engaging experiments. The project was aimed at GSCE and A level students, and teachers said that the students' confidence grew throughout the project.

The UK Space Agency's funding contributions for the Novium museum exhibit targeted 13,425 people and achieved about half of that. Feedback was positive and the space angle has allowed the museum to connect with new schools in the area. The money invested has allowed Novium to build a popular long-term learning offer around space and Tim Peake.

Astro Pi was a collaboration with UKspace and the Raspberry Pi Foundation. The low numbers of children engaging in computer programming leads to too few workers with these skills, affecting the space industry and other high-tech sectors. There was a small initial uptake of around 500 people, but after learning lessons about under-resourcing and entry barriers, the team were able to build up to an audience of 17,000 people using events like the Big Bang Fair and the Bett education show.

Despite national coverage, the Great British Space Dinner didn't get the expected traction with only 2,000 competition entries from young people. As the project launched early on – in May 2014 – awareness of Tim Peake and his mission was limited. A partnership with a Channel 4 production company was hampered by a mismatch in target audiences since Channel 4 has a mainly adult audience. However, the education resources are still used in schools and are some of the most popular downloads by teachers on the ESERO website.

PRINCIPIA SCHOOLS CONFERENCE

The Principia Schools Conference celebrated the achievements of students who had taken these projects furthest. It was a chance for them to feel part of the sector and to present results at a serious conference, just as 'real' scientists do.

Around 800 students from around the UK attended a conference at either the University of Portsmouth or the University of York. Both conferences included hands-on activities for locals. Every student presented their findings to an audience of their peers and professional scientists, and met Tim Peake personally.

90% of teachers, parents and carers who attended the schools conference said it would have a lifetime or long-term impact

The feedback from the conference was overwhelmingly positive. 68% of groups attending reported that the impact on the child most affected would be life changing. A further 26% said that the impact would be long term and change views for years into the future. The positive impact wasn't just felt by students: 90% of teachers, parents and carers reported lifetime or long-term impacts.

800 young people presented their work on Principia at two schools conferences

Over 900,000 young people have taken part in workshops and events at science centres across the UK

The results

Over **1.6 million children** and young people from around **10,000 schools** engaged in the Principia education and outreach programmes...

...equivalent to around **15%** of the total UK school population in any year and **1 in 3 UK schools**

The average cost per engagement was just over **£1** and many young people took part in several activities

When including ongoing projects, the overall total exceeds **2 million children** and young people

We reached schools and pupils in **primary, secondary and post-secondary** education

The education programme reached schools with **higher than average** numbers of children eligible for free school meals

Schools and participants from England, Scotland, Wales and Northern Ireland were all **well-represented**

Schools from large urban centres, towns and cities, rural villages and small hamlets were **well-represented**

Engaging with Tim Peake's mission spurred individual students to **pursue careers in STEM** subjects

The programme empowered and educated **teachers** as well as students

Partnering with **organisations outside the space sector** had some of the biggest impacts on new audiences

Young people usually become less interested in science throughout secondary education – but those who took part in the programme reversed the downward trend and remained **positive about science**

Conclusion

The programme clearly met and exceeded all of its objectives. The total number of children reached, known to be at least 1.6 million and estimated to have topped 2 million, far exceeds the target of 480,000 defined in our mission.

The large majority of the projects focused on primary school ages, our key target audience. However, the 34 projects reached across age ranges, from the earliest school years through to university students and the general public.

Every region of the UK ran school activities, with a balance of urban and rural schools and schools in deprived areas. The programme was particularly successful in attracting a diverse range of children, with above average numbers of schools with high proportions of pupils eligible for free school meals and pupils whose first language is not English.

All projects were equally accessible to boys and girls and, where gender was noted, this the same right across the UK.

Legacy

The impact of Tim's mission continues to be felt in and out of schools.

Within schools, there have been lasting impacts where the senior management team embraced the whole Principia mission. Evidence from secondary schools where this has been the case shows an increase in pupils taking STEM subjects.

"The buzz and excitement from the children was something we've never seen before in school."

Feedback on the schools conference

"Can we do this every day? This is amazing! I'm working so hard!"

Feedback on the Space to Earth Challenge

Tim has also captured imaginations outside of formal schooling. The BBC's 500 Words writing competition has around 120,000 annual entries from boys and girls around the UK. Tim had never previously appeared in the analysis of the competition but went straight to the top five most frequently named famous people, topping Shakespeare's Romeo and Macbeth, politicians David Cameron and Barack Obama, and even James Bond and Harry Potter.

The programme's legacy is also being felt in practical ways. It created resources that are still being used by teachers. Earth and Space is a topic on the English primary school national curriculum, usually taught annually or biennially to years 5 and 6, and is included in the Environmental Studies topic in the Scottish curriculum. Teachers and educators who received training continue to share and incorporate their new knowledge in lessons.

The power of space

"This was a project and experience that grew and grew and the proudest achievements I've taken part in and led in school. From a tiny 'seed' of an idea to be involved with the rocket science project and watch a UK astronaut blast off into space, destination ISS, this has opened up so many opportunities to work with companies, projects and events in school linked to space and STEM. It has given lots of professional opportunities for other members of staff in school too. I am now trying to find other experiments that as a school we can be involved in which the answer is unknown as I believe that this engages some of the students much more."

Alan Grey, Headteacher of Sandringham School

In many cases the defining feature was the energy and enthusiasm of a few individuals who worked tirelessly to bring their projects to life once they had seen the inspiring power of space. We must also mention the significant contributions from the project partners in in-kind contributions, staff time and volunteer hours and, of course, the passion of teachers, parents and carers in inspiring young people.

This programme could not have been successful without the huge efforts of the European Space Agency to help us, for example by flying equipment and allocating precious crew time. Tim's tireless efforts in supporting the programme were crucial to its success – whether running our activities on the ISS, using his spare time to talk to young people or meeting them face to face during countless events held after his return.

There is much to learn from the education programme, especially from unexpected successes and from projects that did not meet expectations and targets. By building on the learnings and successes of this mission, we can develop more successful STEM engagement programmes and use space to inspire young people during Tim's next mission.

Into the future

Tim Peake was the ideal high-profile role model. He is an excellent ambassador for the UK's space programme, with a truly infectious enthusiasm. His natural rapport with young people of all ages helped engage new audiences from all walks of life.

The UK Space Agency wants to continue the momentum built up surrounding Tim's mission.

At the time of writing it is unknown when he will fly again, but the European Space Agency intends to assign him a second flight.

In the meantime, the UK Space Agency is continuing some elements of this education programme, capitalising on other high-profile UK space activities, and anticipates taking on the challenge again for future human space missions.

FULL REPORT

The full UK Space Agency report on Tim's mission goes into more detail about the education programme and the individual projects mentioned here. It also covers the communications programme supporting Tim's mission (such as publicity and social media), lessons learned and recommendations for the future.

You can read the full report at **GOV.UK**

UK SPACE AGENCY

The UK Space Agency is responsible for all strategic decisions on the UK civil space programme and provides a clear, single voice for UK space ambitions.

At the heart of UK efforts to explore and benefit from space, we are responsible for ensuring that the UK retains and grows a strategic capability in space-based systems, technologies, science and applications. We lead the UK's civil space programme in order to win sustainable economic growth, secure new scientific knowledge and provide benefit to all citizens.

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