Ondata Research

Destination Space Phase 3 Evaluation Report

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Executive Summary

Introduction

Destination Space Phase 3 ran between September 2021 and March 2022. This project is led by the Association for Science and Discovery Centres (ASDC) and funded by the UK Space Agency. This project has operated very successfully for several years, with the previous phase showing the resilience and creativity of the science centre sector as it fell within the COVID-19 pandemic at a time when many centres were unable to open[1].

There were nine participating centres, with all having previously participated in Destination Space:

- Aberdeen Science Centre.
- Dundee Science Centre.
- Dynamic Earth, Edinburgh.
- Glasgow Science Centre.
- National Space Centre, Leicester.
- Observatory Science Centre, East Sussex.
- W5, Belfast.
- Winchester Science Centre.
- Xplore!, Wrexham.

Centres were able to engage over 67,000 people via in-person and digital engagement. The vast majority of activities (around 62,000) were able to take place in person.

ASDC describes the overarching vision of the project as follows:

"To engage, inspire and involve families with school-age children, school groups and communities across the UK with the amazing stories, science and engineering of the UK's world-leading space sector."

Evaluation

A Mixed Methods evaluation approach has been taken for Destination Space Phase 3, using a mixture of qualitative and quantitative data. Data has been collected both by centres and by Ondata Research. The information gathered by centres focussed on metrics describing the activities and included feedback gathered from the different audience groups participating in the activities. This information was supplemented by data collected by Ondata Research,

[1] Thomas, L., Meakin, C. & Johnson, T. (2021). *Destination Space Phase 2.5 Evaluation Report*. Unpublished.

focussing on post-training feedback, the introduction of a staff reflection tool for science centres and end of project semi-structured interviews.

Destination Space Activities

Around 6.5% of the overall activities involved a form of digital engagement. The vast majority of centres were able to return to in-person engagement, with the periods of delivery tending to focus on weekends and during school holidays. Around two thirds of the activities were aimed at a family audience (66.2%), with the others being mainly aimed at school pupils and community groups.

In terms of the space science topics covered, around half linked to the James Webb Space Telescope (51%) with the next most popular topic being spaceports (30%). 16% of the activities linked to COP26 and climate science, with the remaining 3% covering a range of topics, including satellite applications. With regards to collaboration with researchers, one quarter of the events involved contributions from partners. This contribution ranged from leading drop-in activities to giving talks and supporting the development of workshops. The majority of the activities lasted 30-45 minutes (40%) with 16% being drop-in type activities lasting less than 15 minutes.

Responses to a common set evaluation questions across the centres have been brought together to get a sense of the overall experience and impact on audience groups. Almost 300 responses were gathered by five centres covering an audience group of over 1000 adults and children. Across the centres and different types of activities there was a very positive experience reported by audience groups, with 98% saying they agreed or strongly agreed with the statement “We enjoyed taking part in the activities”. Centres were also very successful at helping audience groups to make connections between space science and their own lives, with 82% saying they strongly agreed or agreed whilst 16% were neutral and 2% disagreed. Visitors identified the following connections:

- *“Found out how this links to satellites being launched and how much we use them in our day to day life. Really excited to see these launches happening in the UK”.*
- *“It inspires my children to think of why science and maths are so important.”*

Families were inspired to go on and read more about space science (84% strongly agree or agree) and to talk about it with each other or their friends (85% strongly agree or agree).

There are a range of different benefits to centres in participating in an ASDC-led programme and Destination Space in particular. They are:

1. Staff professional development.
2. Building on previous Destination Space phases.
3. Resource for programme development.
4. Networking and relationship building with partners.
5. Integration with existing programmes, organisational goals and audience needs.

Conclusion

It is clear that the learning and experience from previous phases of Destination Space have been built-on and embedded within programmes and practice in the participating science centres. Audience groups have had a very positive experience of the activities and have been inspired to learn more about space science and have been able to identify connections with their own lives. The flexibility of the grant has ensured science centres have been supported through this challenging time and the activities have formed an essential part of programming. Staff have continued to build their knowledge, confidence and skills with this being cascaded across several staff members within each science centre.

Centres continue to see the potential and the place of Destination Space within their programming and this extends to being able to deliver more activities and reach a wider audience if funding allows. The prestige of being involved in a high-quality project, both in terms of the resources and information provided and the support received, is a strong motivation for continued collaboration with ASDC and the UK Space Agency.

Recommendations

The following points are based on feedback and observations of the Phase 3 activities and are intended to support the further development of an already very successful project.

1. Continue the flexibility of funding for centres, allowing them to integrate it with existing programmes and organisational priorities.
2. Review the visual branding and marketing materials provided to centres.
3. Build-in meetings for centres to share best practice and ask for advice and guidance from colleagues in other centres.
4. Undertake a dedicated study into the impact of participation in multiple phases of Destination Space, building on the points highlighted in recent evaluation reports.
5. Review the evaluation and reporting requirements to ensure they are balanced with respect to the level of grant funding and continue to develop and enhance the evaluation capacity within centres.

Introduction

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There were nine participating centres, with all having previously participated in Destination Space:

- Aberdeen Science Centre.
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ASDC describes the overarching vision of the project as follows:

"To engage, inspire and involve families with school-age children, school groups and communities across the UK with the amazing stories, science and engineering of the UK's world-leading space sector."

Whilst the mission is described as:

"To enable science centres to reach widely across the UK during 2021-2022 to deliver interactive activities with innovative approaches that bring the relevance of UK space to families, schoolchildren and communities across the UK. Destination Space 3 will focus on the space science and engineering of UK spaceports and launchers, climate and COP26 and the James Webb Space Telescope."

[2] Thomas, L., Meakin, C. & Johnson, T. (2021). *Destination Space Phase 2.5 Evaluation Report*. Unpublished.

A set of five key goals have been identified by ASDC:

1. *To engage, inspire and involve school-aged children, their families and their teachers with a sense of curiosity and discovery about the UK's role in space exploration and application, focussed on three key content areas of most relevance for 2021-2022.*
2. *To build on the previous phases of Destination Space and continue to support science capital for families and communities across the UK by promoting the personalised and localised relevance of UK space science to daily life, through the science centres and their regional partnerships.*
3. *To support and empower science centres and their engagement professionals across the UK to refresh their knowledge and regroup teams and expertise, to continue with UK space related engagement activities following prolonged periods of closure and restrictions due to Covid-19.*
4. *To evaluate the programme impact on audiences and their perceived relevance of UK space science, alongside the effectiveness of various blended approaches of delivery.*
5. *To create an online knowledge hub for the three key content areas and a community of practice of engaged, trained UK Space science communicators within participating Destination Space 3 science centres and beyond into the wider network.*

This evaluation report focusses on the impact of the project in terms of it's vision, mission and key goals. The following section outlines the evaluation methodology and approach taken with centres.

Methodology

A Mixed Methods evaluation approach has been taken for Destination Space Phase 3, using a mixture of qualitative and quantitative data. Data has been collected both by centres and by Ondata Research. The information gathered by centres focussed on metrics describing the activities and included feedback gathered from the different audience groups participating in the activities. This information was supplemented by data collected by Ondata Research, focussing on post-training feedback, the introduction of a staff reflection tool for science centres and end of project semi-structured interviews. A full list of the methods can be found in Table 1.

Method	**Purpose**
Activity metrics	To gather consistent information from all centres on the different activities.
Surveys: Family Pupils Teachers	To gain insight into the impact of the activities on the different audience groups. A core group of questions were used with language suitable for the intended audience.
Staff self-reflection	To gather the impressions and assessment of impact on participating audience groups from science centre staff. This tool was added to the methods available in order to capture impact from the viewpoint of the experienced professionals working within the science centres.
Researcher self-reflection	To understand the impact of participating in Destination Space Phase 3 activities on researchers.
Post-training survey	To gather feedback on the training academy and whether or not it prepared science centre staff for delivering as part of Phase 3.
Semi-structured interviews	To provide detailed information on the experiences of science centres participating in Phase 3 in terms of the impact they saw on audience groups and the impact on the staff involved and on their organisation in general.
Programme documentation	To provide further detail of the activities and the operational conditions within science centres.

Table 1. Summary of the methods used as part of the Destination Space Phase 3 evaluation.

Due to the change in approach for Phase 3 and the broad range of activities being undertaken, individual evaluation plans were developed by Ondata Research in collaboration with each science centre. Early in the project, each centre was given an appointment to discuss their activities and their needs before Ondata Research drafted an outline plan based on the discussion. An evaluation plan template can be found in Appendix A. For Phase 3 the aim was to minimise the admin burden on centres whilst also providing support around evaluation and

data collection in particular, as many centres moved from paper-based evaluation to digitally-based methods. A set of evaluation tools were developed with a core group of questions linked to the key aims of the project. An example tool is available in Appendix B.

Descriptive statistics have been used to summarise the level of participation across the centres using the metrics information supplied. A list of the fields collected as part of the metrics table can be found in Appendix C. Reflexive thematic analysis[3] was used to review the qualitative data from staff reflections and the end of project interviews and this was used as a basis for the discussion of the impact of participation in Phase 3 on science centres.

In order to go into more depth in terms of impact of Destination Space Phase 3, the main body of the evaluation report is comprised of a series of case studies, one from each participating centre. These are based on an end of project interview and on data collected and submitted by each centre and highlight a particular activity undertaken and its impact.

Centres commented that the support provided to them for the evaluation was very useful and helped to develop their own knowledge, skills and confidence. The introduction of the reflection tool for staff was particularly welcomed with one centre commenting that this *"empower[ed]"* more staff members within the organisation to be involved in the reporting and therefore allowing for a broader range of feedback to be considered that perhaps would have been missed previously. In addition, whilst some centres regularly use reflective practice they have seen the value of carrying out an end of project/themed reflection as this can bring other insights not necessarily arising from weekly feedback. There were a range of experiences in centres in terms of the success in gathering feedback from audience groups. In general, the updated survey forms were felt to be clear and straightforward with the completion time being shorter than in previous years. Science centre staff felt comfortable asking audience groups for feedback as the questions were straightforward and not too time consuming. The data gathered as part of the evaluation has not only been used as part of this report but centres have also used the feedback to inform the development of their own activities.

[3] Braun, V., Clarke, V. (2019) Reflecting on reflexive thematic analysis, *Qualitative Research in Sport, Exercise and Health*. 11:4, 589-597

Discussion

The first half of the discussion section focusses on the impact of the Destination Space activities on the different audience groups, whilst the second half examines the impact of participation on the science centres themselves.

Overview of Activities

Between October 2021 and March 2022, the Destination Space Phase 3 activities reached over 67,000 people. A broad range of activities were run by centres, summarised in Table 2.

Activity Type	n	Percentage
On gallery drop-in activities	78	34.2%
Family show	56	24.6%
School workshop - primary	33	14.5%
Outreach activity	21	9.2%
Group visit	15	6.6%
Synchronous digital activity	14	6.1%
School workshop - secondary	7	3.1%
Careers event	2	0.9%
Asynchronous digital activity	1	0.4%
Teacher CPD	1	0.4%
	228	

Table 2. Summary of activity types by number and percentage, listing most common activity to least.

As can be seen in the summary, around 6% of the overall activities involved a form of digital engagement. The vast majority of centres were able to return to in-person engagement, with the periods of delivery tending to focus on weekends and during school holidays. Around two thirds of the activities were aimed at a family audience (66.5%), with the others being mainly aimed at school pupils and community groups. Table 3 summarises the different groups.

Audience groups	n	Percentage
Family	147	66.2%
Adult	0	0.0%
Teachers	1	0.5%
Community group	16	7.2%
Other	2	0.9%
0-4 year olds	0	0.0%
4-7 year olds	4	1.8%
7-10 year olds	37	16.7%
11-14 year olds	11	5.0%
14-16 year olds	0	0.0%
16 year old plus	3	1.4%
Public	1	0.5%

Table 3. List of activities by audience group, where n is the number of activities.

In terms of the space science topics covered, around half linked to the James Webb Space Telescope (51%) with the next most popular topic being spaceports (30%). 16% of the activities linked to COP26 and climate science, with the remaining 3% covering a range of topics, including satellite applications. With regards to collaboration with researchers, around one quarter of the events involved contributions from partners. This contribution ranged from leading drop-in activities to giving talks and supporting the development of workshops.

The majority of the activities lasted 30-45 minutes (40%) with 16% being drop-in type activities lasting less than 15 minutes. Table 4 outlines the range in full.

Duration of activity	n	Percentage
<15 mins	36	16%
15-30 mins	61	27%
30-45 mins	92	40%
>45 mins	39	17%

Table 4. Number and proportion of activities grouped according to duration

Before looking at the experiences of the individual centres in detail, responses to the common evaluation questions across the centres have been brought together to get a sense of the overall experience and impact on audience groups. Almost 300 responses were gathered by five centres covering an audience group of over 1000 adults and children. Across the centres and different types of activities there was a very positive experience reported by audience groups, with 98% saying they agreed or strongly agreed with the statement "We enjoyed taking part in the activities". Centres were also very successful at helping audience groups to make connections between space science and their own lives, with 82% saying they strongly agreed or agreed whilst 16% were neutral and 2% disagreed. Visitors identified the following connections:

- *"Found out how this links to satellites being launched and how much we use them in our day to day life. Really excited to see these launches happening in the UK".*
- *"It inspires my children to think of why science and maths are so important."*

Families were inspired to go on and read more about space science and to talk about it with each other or their friends. Table 5 shows the level of agreement with these aspects.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
We are more likely to read or watch items about space science	44%	40%	14%	2%	0%
We are more likely to talk to each other or to friends about space science	45%	40%	15%	0%	0%

Table 5. Summary of responses from audience feedback

The following case studies examine a range of the activities in more detail.

Case Studies

The following case studies provide a look at one aspect of Destination Space Phase 3 delivery within each centre. These have been selected to highlight the range of activities undertaken and the broad impact on the different audience groups.

Aberdeen Science Centre

A wide variety of activities formed the Destination Space Phase 3 programme at Aberdeen Science Centre (ASC). This began with on-gallery drop-in activities before expanding to encompass a centre-wide theme including workshops, demonstrations, storytelling sessions and coding challenges. This case study looks at the experiences of families attending the Destination Space: Hot Stuff workshop and the observations of staff leading the Space on the Spot on-gallery activity.

The Hot Stuff workshop was available to families at weekends and during school holidays between December 2021 and February 2022, reaching hundreds of visitors. This workshop looks at the links between satellites and peoples' lives, including how they are used to support communication and their contribution to monitoring climate change. Real-time satellite data is combined with infrared camera demonstrations and a link is made to the James Webb Space Telescope through experiments with different materials. Linking satellite data and climate change is a new topic for Phase 3 and based on audience feedback, it was an engaging topic for workshop attendees.

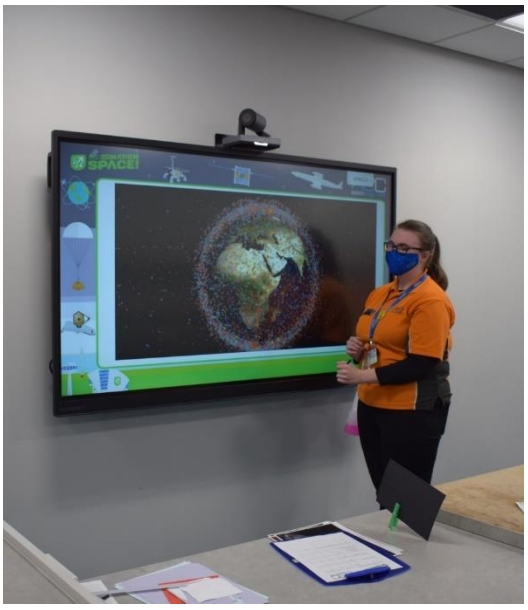

Figure 1. STEM Communicator Eilidh explores the Stuff In Space website as she delivers the Destination Space: Hot Stuff workshop. Image credit: ASC.

All attendees at the workshop strongly agreed (60%) or agreed (40%) that they had enjoyed the activity. The experience impacted on their interest in space science, with 83% saying they were now more interested in the topic (48% strongly agreed and 35% agreed). A significant

proportion of the attendees strongly agreed (39%) or agreed (48%) that they could identify a connection between space science and their own lives. This shows how well the workshop content highlights the applications and links, with the satellite pictures featured and the discussion of how to measure temperature being particularly of interest. In terms of intentions to read or watch more items about space science over 80% indicated they were more likely to do so following the workshop and over 60% indicated they were more likely to talk to friends and family about the topic. The most popular aspect of the workshop by far was the experiments, with staff observing that it was the kit such as the thermal cameras that visitors could *"touch and feel"* which had an impact.

For families attending ASC, in addition to the workshop they were also able to explore space-related activities in the centre, with the Space on the Spot activity being regularly run. This facilitated activity was available in the main exhibition space and incorporated a range of demonstrations based on Destination Space kit. Visitors could stop for an informal discussion with ASC staff, with staff observing that the activity really got the visitors *"thinking about space".* The questions from visitors covered a range of topics, including human spaceflight, black holes, planets and current missions such as the James Webb Space Telescope. Staff were able to use these conversations to recommend books and websites for further reading and suggest other activities they could do themselves at home. Staff were able to draw on their experiences talking to a significant number of visitors to conclude that the Destination Space activities had been successful in inspiring families. There was clear evidence of families intending to go and *"look further into topics at home"* and they were also making plans to return to ASC and participate in more activities. Having the space-themed activities across the centre helped staff to recognise the significant impact the topic can have on both adults and children, with staff motivated to increase their space science knowledge further to enable them to have extended conversations. The mix of activities was found to be particularly successful, with visitors able to engage with a range of workshops, facilitated demonstrations and drop-in activities, allowing for a mix of concepts and topics to be discussed rather than there being pressure on hitting all of the topics and learning points within one workshop.

Dundee Science Centre

Dundee Science Centre (DSC) delivered a range of activities as part of Destination Space Phase 3. However, due to unexpected centre closures and a change in staff involved with the project a number of activities were delivered beyond the March 2022 reporting deadline and there is therefore limited evaluation data available. This case study focusses on staff interactions with visitors at a series of weekends in February 2022. A range of space science topics were discussed with family groups, ranging from spaceports and satellites to rocket launches and the James Webb Space Telescope, with staff able to use their knowledge and experience of the Destination Space workshops and resources from previous phases.

Staff observed that *"audiences tended to find physical, tangible, examples of space based materials to be the most engaging by far"*. This was seen to be the case for a range of different age groups, with the hands-on and interactive elements encouraging further discussion. One aspect which was very apparent within the staff reflections from DSC was the continued adaptation and change of approach taken by staff depending on the audience groups and their reactions, for example one staff member described how they *"adapt the content to suit the audience that I have"*. This highlights an important aspect of the success of the Destination Space Phase 3 project: it is a collaboration between ASDC, UK Space Agency and science centres. ASDC and UK Space Agency support the development of knowledge and skills in relation to space science and the science centres then use their highly-developed communication skills and professional experience to interact with and impact on audience groups. This element of interaction and adaptation particularly contributes to helping visitors make a connection between space science and their own lives, with staff observing that *"the localisation, in particular, inspired people"*.

Dynamic Earth, Edinburgh

October school holidays in 2021 were filled with space science at Dynamic Earth as one element of their Destination Space Phase 3 activities. Visitors were provided with opportunities to get hands on with kit, both large and small, and to meet scientists from the University of Edinburgh's School of Physics and Astronomy and the Royal Observatory Edinburgh (ROE).

The ROE brought along a life-sized mirror segment from the James Watt telescope, which acted as a visual draw for families. Infrared cameras displayed on large screens next to tables were also popular visual hooks that enabled current scientists and students to have conversations with visitors of all ages.

Dynamic Earth staff described the family programme as one of their *"flagship"* activities. The programme is designed to be *"flexible, modular, interactive, fun activities that complement and enhance things that go on in the exhibition".* Delivery of the nine Destination Space family days was undertaken by mixture of Dynamic Earth's planetarium and learning and engagement teams along with researchers and students from the University of Edinburgh. Including partners in the activities is an important element for the Dynamic Earth team as it ensured *"everybody got to meet a scientist as part of the programme across those nine days of activity".*

Staff reflection journals highlighted how the event had sparked conversations about both current and future applications of spaceflight, with a very popular rocket-building activity facilitating one set of discussions with different age groups around rocket design and aerodynamics. Another was the draw of the James Webb Space Telescope mirror with families who were "*excited to talk about a current mission about to head out into space".* Staff found this opening then *"led to discussions about space travel and the UK role in building new space ports"* with a natural extension to careers in the space industry. Staff were also able to identify how the event supported the Destination Space vision to engage, involve and inspire families: *"Many children and families left the session feeling excited and enthusiastic about space".*

In addition to the staff reflections, feedback was gathered from family groups (n=19). All of the respondents said they strongly agreed with the statement that "We enjoyed taking part in the activities." Feedback from families described how the drop-in activities were able to pull them in: *"They looked really fun and we wanted to get involved".*

The activities also increased their interest in space (26% strongly agreed and 74% agreed) and their ability to make connections with their own lives (21% strongly agreed and 58% agreed): *"Space technology plays a huge part in our lives without realising."*

Following the activity 90% were more likely to read or watch items about space (11% strongly agree and 79% agreed) and 100% said they would be more likely to talk to each other or their friends about space (16% strongly agreed and 84% agreed).

Dynamic Earth staff work to support the development of the activities being brought in by partners and offer advice and feedback on their proposals. This step requires an investment of time from the team but results in a highly enjoyable and impactful experience for visitors.

Glasgow Science Centre

Glasgow Science Centre's (GSC) activities for Destination Space Phase 3 involved the delivery of an online Learning Lab, around 'Scotland in Space'. Staff explained that the focus was to encourage S1 and S2 (aged 11-13) pupils to explore the *"science behind rocket and satellite technologies, research applications of space technology, and recognise Scotland's contribution to the space industry and career opportunities in the field."* The team at the centre collaborated with space industry contacts who provided advice on the content of the programme as well as participating in live events that were recorded to form an ongoing careers resource. Teachers then ran sessions in school using standard classroom science kit.

GSC staff undertook interviews with teachers in order to gather feedback on the impact of the programme. This provided detailed insight into how the sessions were received. Many teachers interviewed were in the process of planning the activities for later in the year. Key themes arising related to:

- Pupil engagement: *"the pupils really enjoyed it as space is traditionally a topic of interest to that age group"*. For some of them, this has made them even more interested in the space topic: "*It has pulled them in*".
- The quality and content of the activities: *"The resources, especially the introductory videos look very good"*.
- Links made to Scottish industries: This encouraged pupils to see space science as something local – *"The pupils were surprised as they thought the space industry was in the USA, thinking of NASA."*
- Increased knowledge of teachers: *"I was not even aware of it all, for example the Prestwick spaceport."*

One challenge of running an online course was tracking how many schools were actually participating. The centre asked schools to make a short film about *"celebrating Scotland in Space"*, but this wasn't taken up to the extent the centre expected. External factors due to COVID-19 restrictions are likely to have influenced this. Following the online workshop, some schools were then able to follow this up with a visit to GSC.

National Space Centre, Leicester

In October 2021, the National Space Centre (NSC) focused their activities around the James Webb Space Telescope launch. Like many centres involved with Destination Space, the idea had been to tie in activities with the launch, but due to the date being pushed back until the 25th December 2021, activities provided families with the opportunities to explore the technology of the telescope in the run up to the launch, and to hear from researchers involved in space science.

Over 11 days, around 5000 people engaged with facilitated activities based around origami-folding, infrared cameras, and talks that showcased the scale of the telescope's mirrors, the ingenuity of the folding mechanism and the expectations for the telescope once it was launched. Through collaboration with the University of Leicester, NSC could highlight the local contribution to the development and staff commented that using a model of the spacecraft they *"could pinpoint to people where the bit from Leicester was inside the instrument and how it's going to work".*

Staff observed that people were *"eager to hear more"* about Webb and the practical activities they took part in which related to the mirror segments and origami were particularly helpful when it came to visualising and understanding the scale of the telescope. Staff felt this had a particular impact around giving visitors "*a better understanding of the capabilities of Webb and what results we might get from it."*

There was a high level of enjoyment of the activities as reported via the visitor feedback (n=55) gathered by NSC, with 98% saying they enjoyed taking part (85% strongly agreed, 13% agreed and 2% neutral). The activities were very successful in increasing an interest in space science amongst visitors, with 93% saying they were now more interested (60% strongly agreed, 33% agreed), with the Webb telescope launch being a popular driver of this interest along with spaceports. Staff observed that *"We got some really good conversations with spaceports and people stayed for ages, they wanted to know a lot more."*

In terms of ongoing impact, following the activity 93% were more likely to talk to each other or their friends about space science (60% strongly agreed, 33% agreed) with questions such as *"Why is the gold plate in layers?*" being of interest. Whilst 85% were more likely to read or watch items about space science (58% strongly agreed, 27% agreed).

A significant proportion of the respondents were able to identify connections between space science and their own lives, however 15% were still uncertain as to how it was relevant. For those who did identify a connection, this linked to technology they used every day and the data and information from satellites, for example for weather reports.

Observatory Science Centre, East Sussex

The Observatory Science Centre focused on revamping their existing Destination Space project as a key part of their Phase 3 activities. A member of staff incorporated the new content around James Webb Space Telescope and climate, bringing new topics into their previously developed show, aimed at a family audience.

Across the run of the show around 1200 people took part and experienced the space-science themed demonstrations and newly incorporated videos. The Observatory Science Centre gathered feedback from a number of families attending the shows in February half term (n=64). The activity was positive one for families, with 95% of survey respondents saying they enjoyed taking part (73% strongly agreed, 22% agreed and 5% neutral). People's interest in space science also increased, with 92% indicating they were more interested in space science following the show.

Staff were able to use the feedback on the show to further inform its development. One comment in particular from an audience member was on the language within the show, which had been influenced by earlier phases of Destination Space where the focus had been on Tim Peake's mission. This meant that a lot of the gender references made within the show were male. As a result the language was updated to ensure everyone was able to see space science was *"for them"*.

Wider feedback collected suggested the show provided opportunities for prompting intergenerational discussions with one visitor commenting *"we love talking to grandchildren about innovation in life"*, as well as an awareness of core science principles *"science allows you to challenge ideas"*. These findings are consistent with the audience feedback on whether they were more likely to talk to friends and family about space science, with 86% now more likely to do so (56% strongly agreed, 30% agreed, 14% neutral). In terms of reading or watching more around space science, 78% were more likely to do so after the event (47% strongly agreed, 31% agreed, 19% neutral, 3% disagree).

The show also provided opportunities for raising awareness of the purpose of space-science and its use in everyday life (*"from mobile phones to weather reports, we use them all"*) and its potential applications for the future ("*telescopes detect objects flying towards Earth*") with 84% indicating they were better able to identify connections between space science and their own lives (45% strongly agreed, 39% agreed ,16% neutral).

W5, Belfast

At W5 in Belfast, a rocket building activity was a very successful way of engaging family audiences with space science, with over 1100 people taking part. W5 staff observed that *"Audiences love rockets… They are a great hook and provide plenty of time to have conversations while they are being built."* Not only was this a successful way of stimulating conversations, it was a way for families to *"work together and learn together".* This intergenerational experience also generated conversations within families about space science, and with the learning team at the centre with question around the *"potential for space travel"* and life on other planets being popular areas of discussion.

W5 reopened in October 2021 after a period of redevelopment and staff were able to use the reflections as part of the Destination Space project to help them improve the activity and consider how they are using the new spaces available to them in the centre. There was also evidence of staff identifying further areas for development, for example ensuring they are up to date with the latest space science featured in the news, to allow more detailed discussions with visitors.

Staff see the rocket building activity as a *"hook"* for involving visitors in conversations about many different space topics, including spaceports, satellites and the James Webb Space Telescope: "*all of those key messages were really supported through rockets."*

Winchester Science Centre

Winchester Science Centre focused their Destination Space Phase 3 activities on working with primary schools on the Isle of Wight. The centre visited each school with their planetarium dome to run a day of space-based activities. The visit was supported by a pack for teachers including information on STEM topics and careers. The schools were selected as the proportion of children in receipt of free school meals was over 40%. The teachers were very grateful for the in-person visits as they tend to have limited opportunities due to their geographical location. A science centre staff member described the format of the visit:

"The shows focused on how we use technology, such as satellites, to understand more about the environment on different planets, focusing on planet Earth. At the end of the show students were asked to discuss what they could do to protect Earth and come up with a class climate pledge. The show was interactive and students were able to ask questions throughout and at the end."

To help understand impact, the centre undertook a pre-visit survey with teachers and pupils. The responses to the teacher questions were able to provide insight into the levels of interest in space and whether pupils were able to connect it to their own lives. It is clear that whilst there is a strong interest in space topics (with 88% reporting their pupils enjoyed learning about space) only 24% strongly agreed or agreed with the statement *"my pupils are able to identify connections between space science and their own lives".*

There was clear impact on the pupils and teachers beyond the one day visit, with teachers commenting that the day *"engaged the children and the teachers, they were inspired to research and explore space further".* The careers videos helped pupils to make connections to their own lives and see the potential for a career in the space industry for themselves and teachers also reported that pupils went on to talk to their parents about space science and potential careers.

In general, teachers and pupils increased their knowledge of space science and were able to see opportunities for themselves in the industry. For the centre, this was an opportunity to further develop relationships with schools in areas of deprivation with the workshops delivered as part of Destination Space Phase 3 forming the beginning of a long-term partnership.

Xplore!, Wrexham.

Xplore! used Destination Space Phase 3 as an opportunity to redevelop some of their existing shows to include updates on the James Webb Space Telescope and to trial new resource packs that were given to schools as part of their outreach work.

The newly re-developed show was used across many activities, including astronomy clubs. Facilitators from the centre and local amateur astronomers provided opportunities for participants to get hands-on with activities alongside *“using a 'proper' telescope”*, and where families were also encouraged to bring along their own kit. Several families took this opportunity and Xplore! staff were able to offer *“advice on how to get the most out of their machines.”*

Feedback from the families who attended the astronomy club sessions was extremely positive. 78% strongly agreed or agreed that their family was more interested in space science as a result of taking part in the club. The club was also felt to complement formal learning for the younger participants, with one parent commenting that *“It is reinforcing what my children are learning in school”*. This was also an opportunity for families to explore science together with 87% saying they strongly agreed or agreed that they were more likely to talk about space science with each other as a result of taking part.

Science Capital

One of the key goals of Phase 3 was to "*build on the previous phases*", particularly in terms of developing science capital through the personalising and localising approach in showing audience groups how UK space science connects to their daily lives.

The theory of Science Capital helps to describe someone's connection to and interest in science[4]. People have different levels of Science Capital and those with higher Science Capital are more likely to have an interest in science and/or a science-related career. The Science Capital Teaching Approach (SCTA) was designed for use in schools by teachers but is commonly used in informal settings such as science centres[5]. The foundation of the SCTA is "broadening what counts" [6] whereby people are encouraged to identify the science around them and connected with their own lives.

On top of the foundation of "broadening what counts", there are three pillars to the Science Capital Teaching Approach:

1. Personalising and localising.
2. Eliciting, valuing and linking.
3. Building the science capital dimensions. The dimensions are:
    i. Scientific literacy: knowledge, understanding and confidence in relation to science.
    ii. Science-related attitudes, values, and dispositions: whether someone sees science as relevant to their everyday life.
    iii. Knowledge about the transferability of science: awareness and understanding of the application of science skills and knowledge.
    iv. Science media consumption: whether someone engages with science-related media including television, books, magazines, and online content.
    v. Participation in out-of-school science learning contexts: whether someone takes part in informal science learning contexts, such as science museums, science clubs and fairs.
    vi. Family science skills, knowledge, and qualifications: whether someone's family have science-related skills, qualifications, jobs, and interests.

[4] Archer, L., Dawson, E., DeWitt, J., Seakins, A., & Wong, B. (2015a). "Science capital": A conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52(7), 922-948

[5] Science Museum Group (2021) Science Capital in Practice. Available: https://learning.sciencemuseumgroup.org.uk/academy/academy-training/science-capital-in-practice/

[6] Godec, S., King, H., & Archer, L (2017). The Science Capital Teaching Approach: engaging students with science, promoting social justice. London: University College London.

vii. Knowing people in science-related roles: to what extent someone knows of people in their wider family, friends, peers, and community circles who work in science-related roles.
viii. Talking about science in everyday life: whether someone engages in discussions about science with key people in their lives (e.g., friends, siblings, parents, neighbours, community members).

Throughout the case studies there were many examples where science centres were able to personalise and localise the content. In some cases this focused on UK involvement more generally, but where the centres had partnerships with local researchers (for example Dynamic Earth and the Royal Observatory Edinburgh, the National Space Centre and the University of Leicester) opportunities were taken to highlight these links.

There were many different opportunities for centres to engage in discussions with audience groups, rocket-building and other drop-in activities particularly supported this. Through this, science centre staff were able to adapt the content and react to the level of knowledge and understanding of the audience. They were able to answer questions from the audience groups and link their knowledge to the activities and topics on offer.

With regards to the third pillar of building the science capital dimensions, there were particular aspects successfully met by the Destination Space Phase 3 activities.

i. Scientific literacy: there were natural opportunities for audience groups to develop their space science knowledge, whether it was through participation in a show or workshop or through a drop-in activity.
ii. Science-related attitudes, values, and dispositions: the discussions between science centre staff and the audience groups were able to help them make connections between their own lives, as did the reference to local connections and conversations with researchers.
iii. Knowledge about the transferability of science: the rocket-building activities were excellent examples of the science centre staff being able to develop the audience group's knowledge and apply it to a specific mission (such as the James Webb Space Telescope) or to satellites and how data captured can impact on them.
iv. Science media consumption: feedback from audience groups indicates that there was an increased interest in space topics, resulting in an intention to read more about space science in general.
v. Participation in out-of-school science learning contexts: the majority of the activities for Destination Space Phase 3 were "out-of-school" settings, with a

handful (Winchester in particular) being in-person visits. However, centres who engaged with schools saw this as part of a wider engagement with the community and a route to encouraging pupils to come to the centre with their families.

vi. Family science skills, knowledge, and qualifications.

vii. Knowing people in science-related roles.

Taking dimensions vi and vii together, science centre staff and the partner researchers and students were available to the audience groups as positive role models. This is particularly important in the cases where people are not aware of family and friends working in science-related roles.

viii. Talking about science in everyday life: there were many instances of intergenerational discussions taking place in families, between grandparents, parents and children and many reported the increased likelihood of this continuing following the activity.

The content of the Destination Space Phase 3 activities combined with the delivery approach and discussions between science centre staff and audience groups has been discussed in relation to the three pillars of science capital, with there being many contributing factors coming together to help build the level of science capital amongst the different audience groups.

Impact of participating in Destination Space Phase 3 on science centres

There are a range of different benefits to centres in participating in an ASDC-led programme and Destination Space in particular. The key areas are discussed below.

1. Staff professional development

Since the first phase of Destination Space in 2016, science centre staff have moved around within the sector, so some staff who are currently involved may have had experience of the project win a different organisation to the one they are in at the moment. Having a long-term, consistently available project focused on space science has ensured a secure legacy of knowledge, skills and confidence amongst staff. With regards to the project management and delivery, many centres share this across multiple staff ensuring there is resilience and back-up in terms of project knowledge. This has been especially important at a time when science centres have had to react to staff shortages due to COVID-19 and changes in staffing levels overall.

One member of staff referred to experience of project managing an ASDC project in a science centre as a *"rite of passage"* for staff members. This shows the high regard for the projects as an important aspect of personal development for staff. The combination of the training academy where staff develop knowledge, skills and confidence with the chance to expand their own personal network along with the experience of then delivering the activities and managing the reporting and evaluation processes is a rich and rounded staff development opportunity. One staff member observed that the roles within science centres tend to be delivery-focussed, but ASDC projects helps to "*widen the opportunities for the teams to try out different things and use different skill sets."* Destination Space also provides content and kit which the individual centres themselves would not necessarily have time and resources to develop. Within the science centres multiple staff are impacted, as training is cascaded to those delivering workshops and facilitating on-gallery activities. Experiences of these projects can also highlight where further knowledge can be developed or where a particular topic sparks interest with visitors. For example, at the conclusion of the project one staff member reported the intention for them to use space as a hook with visitors more regularly as the *"excitement around space themed topics made me realise how well people engage with such themes."*

2. Building on previous Destination Space phases

There was also evidence of previous Destination Space content having been incorporated into annual programmes of activities in several science centres ("*the legacies of these ASDC projects are very valuable to us*"). The high quality of the kit in particular has been noted by

several centres and it is regularly used and for one centre they described the presence and influence of Destination Space as being "*pervasive*" across their programming. The kit was also important in supporting a "*more tailored experience*", as staff were able to use them as conversation starters, prompting questions from visitors.

For Phase 3, the topic of satellites and how they contribute to understanding climate change has been successfully incorporated into ongoing current programmes for several centres. There is definitely a sense of each phase of the project building on the one before, one project manager observed that *"each one [phase] kind of adds more to our repertoire really, and our programming going forward. And the legacy just keeps growing and growing."*

With regards to impact and legacy of work within science centres, staff are noticing a broader shift from only being interested in the numbers being reached to the depth of the engagement and wider impact: *"I do feel there is starting to be a step change more generally in the sector to 'is it actually numbers we care about, or is actually the case study that shows that depth and degree of change or the sustainability of that relationship?'"* Many of the Destination Space Phase 3 activities were part of a broader relationship development goal. For example, Winchester Science Centre using this as an opportunity to establish connections with schools in deprived areas on the Isle of Wight. Being a part of this project also raised the profile of the centres with other stakeholders and the collaboration with UK Space Agency was a draw for audience groups.

3. Resource for programme development

Staff enjoyed having the focus on space science as a result of the Phase 3 funding as it allowed them a dedicated "*channel*" through which to share their "*enthusiasm*" for the topics and to use their "*creativity*" when interacting with audience groups, without this funding some centres would not be able to have as much dedicated time focused on space science development and delivery.

4. Networking and relationship building with partners

Science centre staff felt *"very well supported"* by the ASDC team. They appreciated the regular check-ins and when ASDC were able to highlight relevant connections and with other organisations such as STFC and how to connection to other opportunities outside of the project such as 'Mars Week'. It is important for centres to collaborate with peers and there is a sense of "*pride*" being involved in national programmes being run by ASDC. This combined with the topical science being brought to the project through the UK Space Agency partnership is something centres feel brings further *"status"* to being involved, making engagement with researchers easier to achieve. At the end of March 2022, ASDC were able to arrange a

meeting for centres to share their experiences of Phase 3. This provided centres with an opportunity to share the types of activities they had run. Four of the participating centres were able to attend the meeting and they were joined by ASDC staff, with the session observed by Ondata Research. The discussion between colleagues was open and honest, they were comfortable asking each other questions, whilst the discussion offered examples of best practice and general advice and guidance. In general it was an important event in terms of relationship development between centres and ASDC. It was a chance for centres to feed back directly to ASDC staff and for them to ask for comment on upcoming projects and opportunities.

5. Integration with existing programmes, organisational goals and audience needs

In terms of the grant, science centres felt there was *"more we could do if we had more resource"* but that the most important feature of the Destination Space Phase 3 grant highlighted by all centres was its flexibility. The flexibility had a range of impacts, not least that it allowed for the Destination Space to integrate well with existing programmes of work to ensure projects are *"complementing and enhancing each other and aren't competing"*. One of the ways in which the flexibility helped was the freedom for centres to identify the audience groups they wanted to work with rather than having to deliver sessions solely to community groups or particular ages of school groups. This further enhanced the compatibility with their existing programmes.

"Taking kind of the pressure off of having to hit certain targets for certain age groups, in a certain timeframe, has really helped us as they've just allowed us to be flexible and play to our strengths."

Ultimately centres felt that the flexibility resulting in them being able to *"[maximise] what we can do within the project timeframe"*. Some centres were also able to "*adapt*" their offer during the course of the project as they reacted to differing levels of interest with audience groups. For example, the National Space Centre were able to increase sessions for home educators as there had been lower uptake from schools. The flexibility also meant that as Phase 3 was over a significantly shorter time period than previous phases, science centres could react and integrate the project within existing plans. This meant that the flexibility also contributed to centres being able to embed the experience from previous phases within their programmes. For example, some centres had a clear focus on working with partners in deprived areas and for Phase 3 they were able to use the activities to build on previous experiences with Destination Space and use these as a *"vehicle to test some of the things that we've been talking about for a while".* This also meant they could connect Destination Space with other projects rather than needing to have it stand alone and one centre felt this meant there was a "*higher level of impact and to be able to tie into repeat engagement*".

The main challenges in relation to delivery of the project were linked to COVID-19. For example, staff shortages due to illness and lower than expected attendance at activities also due to illness. There were also continued restrictions on the maximum number of visitors in different areas of the centres, which for some meant they were not able to run their normal programme of workshops and shows. When pulling together face-to-face activities where partners were involved, some centres found there was a reluctance and lack of confidence amongst researchers and other stakeholders to return to doing something in-person, which meant extra time and effort was required to recruit and reassure partners. For others there wasn't as much reluctance amongst partners, although the centre did invest time in sharing risk assessments and talking through the COVID-19 restrictions in place within the centre. There seemed to be a particularly slow return of school groups and this meant some centres had to evolve the activities on offer in order to meet the target audience numbers.

At the outset of the project, due to the uncertainties around COVID-19 restrictions, there was an expectation of a reasonable proportion of activities being online. However, centres found both audience groups and partners were keen to return to in-person activities. For some this has meant their online offer has dropped back to what it was pre-pandemic. The perception amongst some centres is that whilst it was "*nice*" to be doing activities online, it's "*better*" to be working face-to-face. However, via the online offer centres are able to support vulnerable groups who are perhaps unable to return to visit in-person at this time and they are able to maintain a wider geographical reach through this approach.

Conclusion

It is clear that the learning and experience from previous phases of Destination Space have been built-on and embedded within programmes and practice in the participating science centres. Audience groups have had a very positive experience of the activities and have been inspired to learn more about space science and have been able to identify connections with their own lives. The flexibility of the grant has ensured science centres have been supported through this challenging time and the activities have formed an essential part of programming. Staff have continued to build their knowledge, confidence and skills with this being cascaded across several staff members within each science centre.

Centres continue to see the potential and the place of Destination Space within their programming and this extends to being able to deliver more activities and reach a wider audience if funding allows. The prestige of being involved in a high-quality project, both in terms of the resources and information provided and the support received, is a strong motivation for continued collaboration with ASDC and the UK Space Agency.

Recommendations

The following recommendations are based on feedback and observations of the Phase 3 activities and are intended to support the further development of an already very successful project.

6. In terms of the science centres, the flexibility of the funding for Phase 3 has been a central aspect to its success. Having the opportunity to partner with ASDC and UK Space Agency on space science topics is a key driver for participation but centres are not keen to return to a model where the activities and resources are prescribed. Centres are keen for the flexibility of the funding for Destination Space to continue. Many would not have been able to participate in Phase 3 without this approach. As discussed, there were many benefits to this approach and it allowed for the project to be strongly integrated with existing programmes and contributed to meeting the goals of the different science centres.
7. One aspect arising from interviews with science centres was the visual branding of the project in centres. For those running in-person activities being able to use tablecloths, flags and other types of branded items has been helpful. These were supplied in earlier phases of Destination Space with a focus on digital assets in the current phase. It may be helpful to revisit project branding with centres to find out what they use and what they would like in the future. This aspect can become especially important when centres are involved in multiple projects, such as both Destination Space and Operation Earth and for when they are running activities in external venues.

8. Centres are keen to find out more from each other about what they have been running in Phase 3. They are proud to be part of a national programme that reaches a large audience but they are also interested in how the engagements took place. It is recommended that ASDC's final report or the evaluation report should be shared in some form with centres to allow them to get a sense of the broader work going on across the project. This supports further development within centres as they themselves are inspired by best practice. There is also the opportunity to build on the end of project meeting as not all centres were able to attend. This meeting was not in the original commitments for centres but could be built into any future project timeline to embed an opportunity for feedback and relationship development between the centres and between themselves and ASDC.
9. Multiple staff members within each centre have knowledge of the resources and activities for Destination Space and this has benefited other programmes of delivery within centres, so the impact of the project is not siloed within solely Destination Space events. There is therefore an opportunity to undertake a wider study of impact of the project in science centres and how the impact has cascaded across different areas of working.
10. Review the evaluation and reporting requirements to ensure they are balanced with respect to the level of grant funding. Phase 3 was a shorter term than previous phases and whilst the reporting was reduced and the evaluation aimed to flexible, centres still needed to spend reasonable amounts of time on these aspects. A longer-term project with a higher level of funding is desirable for centres as it provides security in terms of funding and resource. Being able to offer higher funding over a longer term would help to balance out the reporting requirements.

Appendices

Appendix A – Evaluation plan template

- Please complete and return this form to Ondata Research before your appointment.
- The aim of the appointment is to run through the different Destination Space-related activities and the evaluation evidence which will be available to show impact.
- The table below contains information from your application form. Please complete the remaining columns. This will form the basis of the discussion when we meet.
- There are some additional questions below the table which we would find useful for you to answer ahead of the appointment too.
- In preparation for the appointment, it would also be helpful for you to consider what would be realistic in terms of data collection surrounding the different activities. E.g. what proportion of attendees would be likely to return surveys, how regularly would staff be available to undertake observations of drop-in activities, etc?
- If you have existing tools available for use and are happy to share those with us, please send them across with your completed form.
- Please note: there are a set of **common questions** we would like to use across all centres for the Destination Space activities and these can be found on the final page of this document. The implementation of these will be discussed at the appointment also.

Description of the session/activity (taken from your application form)	**Key audience**	**Delivery mode**	**Aims of the session/activity. Please include 2 or 3 aims which summarise what you want to achieve in terms of impact.**	**Evaluation comments and summary of agreed approach**

The following core set of questions should be used with the general public or a family audience:

Following the show/visit/activity:	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
We enjoyed taking part in the activity.					
We are more interested in space science.					
We can see a connection between space science and our own lives.					
We are more likely to read or watch items about space science.					
We are more likely to talk each other or to friends about space science.					

Appendix B – Example evaluation survey tool

Survey for families following attendance at a show or a set of themed activities in the centre. This is NOT suitable for use following a single short (<15 minutes) drop-in or busking-type activity.

To be set up by centre on MS Forms or similar. Please include your GDPR declaration at the start to inform people about how the information will be used.

Questions:

1. Date of visit (so this can be matched to the activity type in the metrics template).
2. Activity name.
3. Was the activity
4. Online?
5. In-person?
6. Number of adults
7. Number of children
8. Age(s) of children

Following the show/visit/activity:	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
We enjoyed taking part in the activity.					
We are more interested in space science.					
We can see a connection between space science and our own lives.					
We are more likely to read or watch items about space science.					
We are more likely to talk each other or to friends about space science.					

- How do you think space science plays a part in your everyday life?
- What motivated you to join today's activity?
- What was your favourite part of the event and why? Please list more than one thing if group members have different favourites.
- Please add at least one additional open-ended question relevant to the activity.

Appendix C – Information collected on activities

1. Name of centre.
2. Date of activity.
3. Project name.
4. Activity type.
5. Short description of event/activity.
6. How does the activity/event fit within the project?
7. Please provide further comment on how the activity links to the aims of the project.
8. Number of people reached.
9. Audience type.
10. Length of activity.
11. Involvement of researchers?
12. If yes, how?
13. Any other audience insights available? E.g. proportion of audience from 20% most deprived areas or proportion of first time visitors.

About the authors

Ondata Research collaborates with clients to help them understand project impact, whilst also providing mentoring and support through the phases of project development and delivery.

Laura Thomas

Laura has extensive experience with a range of education projects across formal and informal education. In addition to evaluation she is experienced with project and resource development, delivery and training for a variety of organisations such as schools, science centres, museums, education charities, universities and professional bodies. She is undertaking PhD research relating to professional development of teachers after having completed an MRes in Educational Research with the University of Stirling.

Clare Meakin

Clare has worked in science engagement for national and local museums in London and across Scotland for the past 10 years. Working in both delivery and development, her museum-based projects have ranged from tinkering workshops for secondary students to science events for over 4,000 people. Most recently as Science Engagement Manager at National Museums Scotland, her work has focused on science engagement strategy development alongside evaluation of a wide range of funded STEM projects for funders such as Scottish Power Foundation, the Scottish Government and Children in Need. As a freelancer she has worked with regional museums such as Andrew Carnegie Birthplace museum on ASN and digital science engagement, and previously worked directly with primary schools for outreach, after school STEM clubs and teacher consultations

Tania Johnston

Tania has been working in the field of science communication since 2002, and in particular in science centres with a focus on astronomy and space science, since 2006. She has experience developing and delivering hands-on workshops and talks on a variety of scientific topics, to a wide range of audiences. During her 9 years working as Public Engagement Manager for the Science & Technology Facilities Council, Tania developed curriculum related educational material and worked closely with the Physics teaching community in Scotland, to support the use of astronomy and space science as a context for teaching science at all levels. Since 2015, Tania has been working for the European Southern Observatory – the world's most productive ground-based astronomy organisation – managing the ESO Supernova Planetarium & Visitor Centre.

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