

# Mission X

## Evaluation Report

By Laura Thomas, Clare Meakin and Heather MacRae

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## Executive Summary

This evaluation report reviews the Mission X delivery model and identifies areas of impact on young people and Team Leaders, before going on to make recommendations based on the findings.

Mission X is a STEM enrichment challenge for young people aged 8 to 12, led by the European Space Education Resource Office for the UK (ESERO-UK) at the National STEM Learning Centre. Teams participate in Mission X during a defined challenge period and gain points for each activity completed. Points are submitted online with the goal being the international 'Walk to the Moon' challenge to help the Mission X mascots to walk the distance between the Earth and the Moon. In normal years the challenge takes place January to May, but this was extended to July in 2021 due to the COVID-19 pandemic. The cross-curricular subject areas covered by Mission X include fitness, health and nutrition along with STEM-related space activities. The overall context drawing the activities together is that of "training like an astronaut". A set of resources and supporting materials are available to Team Leaders. Team Leaders can register their group ahead of the January start or once the challenge has begun (they can register up until 6 weeks from the end of the challenge) and they are supported throughout the course of the challenge by an ESERO-UK Project Officer. There is flexibility around how long and often the teams engage with the activities, with many being undertaken outside of the challenge period.

### *Impact on young people*

ESERO-UK have identified three intended outcomes for the Mission X challenge and the evidence for each is summarised in turn.

- Increased confidence in learning science and working scientifically.  
Team Leaders observed a clear increase in the young people's "*interest and awareness*" and "*understanding*" of the natural world.
- Increased enjoyment and engagement in science.  
The young people taking part "*really enjoyed*" the activities and found them engaging: "*Children were very engrossed with the activities*" (comment from post-participation survey). Each of the aspects of Mission X combines to provide an enjoyable and engaging experience of science: "*The children are active and they're learning, and so there's a competition element to it as well.*"
- Increased knowledge of space.

The young people were able to improve their knowledge of space as part of their participation in the project. In the post-participation survey 14 out of 21 respondents indicated that their young people had an increased knowledge of space.

### *Impact on Team Leaders*

For Team Leaders, there were a range of impacts. For teachers, there was an opportunity for improved knowledge and skills with regards to space and STEM-related topics. For parents and carers, Mission X provided a wealth of easy to use cross-curricular resources. In general, the Team Leaders felt the resources were something they wouldn't come across elsewhere and would not have thought of doing themselves. This impact extended to breaking down barriers between subjects within schools: *"It enabled me to build up relationships with teachers in art, music, English and PE rather than purely in the science faculty"* (Team Leader quote from previous case studies). The opportunity for project management was another area of skills development for teachers.

### *Mission X during the COVID-19 pandemic*

In a period of uncertainty and difficulty during the COVID-19 pandemic, Mission X activities played a role in delivering curriculum-related content and ensuring young people took part in some physical activity. With the challenge activities already being available online, there was no adaptation required to allow the activities to be delivered in the changed circumstances due to lockdown. There were different ways in which Mission X was of value to Team Leaders (teachers and parents) during lockdown:

- One school was able to use Mission X with their whole rural school in order to teach science during lockdown as *"it was really hard trying to cover the curriculum with parents that had one computer"*.
- Young people were able to take part in the activities at home and then when they returned to school. It was *"quite inspiring to come back to it [Mission X] and really good to come back to a fun topic"*.
- The PE activities helped schools to ensure their pupils weren't just *"sitting at home"*. *"It was easy"* to combine different activities such as the 26.2 challenge, crab and crawl along with the Daily Mile to make up a regular PE slot at home.
- The flexible delivery model also meant it felt inclusive and brought different classes together at a time when they were being kept apart physically: *"It was great that we could run it throughout the school especially being in bubbles it gave us a feeling of being together despite not"* (comment from post-participation survey).

### *The Mission X Delivery Model*

The key to the success of the Mission X delivery model is its flexibility. Team Leaders find it “easy” to sign up and access the resources. The cross-curricular activities are used with young people across a wide age range (year 5 is a common age group in schools) including those younger than the 8 to 12 years the resources have been developed for. With regards to workload, Team Leaders have found this “manageable” and for those working in schools the packs have been developed in such a way as to make it “easy to scale up, scale it down”. One teacher felt that it was necessary to have someone to “drive it” who is “passionate about space”, however there are many examples of Mission X supporting the development of this passion in teachers. Mission X is an opportunity for teachers to build their interest and passion about space. For example, one teacher described their journey: they talked about getting involved, having a go, seeing how it works for them and then in subsequent years adapting and adding to it. Through this process teachers themselves are building their confidence and knowledge of space and the Mission X activities.

### *Recommendations*

Based on the findings there are a number of recommendations made to further enhance the challenge.

1. Establish a set of intended outcomes for Team Leaders (teachers, home educators and community group leaders to be described separately) to join those already existing for young people participating.
2. Develop an evaluation framework linked to the intended outcomes, identifying the range of available data to monitor and identify impact.
3. Project Officer to expand on the work already being undertaken on relationship building with Team Leaders. This activity can encompass various aspects, outlined below.
  - a. To support the running of the challenge and uptake of the activities, develop an expanded welcome pack for Team Leaders.
  - b. Develop more explicit links to existing careers information.
  - c. Offer an optional training session or sessions for Team Leaders.
  - d. Aim to develop a peer-written guide for Team Leaders.
  - e. Increase the advice and guidance available for those working with young people aged 8 and under.
  - f. Maintain a calendar of events which Mission X could be tied into.
  - g. Develop a social media engagement strategy to encompass different platforms.
4. Review the existing resources.
  - a. A review of the activities where equipment is required should be undertaken.

- b. Undertake a curriculum mapping exercise for the four nations of the UK. Review the resource formatting and file types available.
  - c. Revisit the Tim Peake-related activities.
  - d. Collate activities suitable for delivery in an outdoor setting.
  - e. Highlight Mission X as inclusive for young people of all abilities.
  - f. Include Mission X on STEM Learning's [cross-curricular topic pages](#) and on pages such as the [Year 5 Earth and Space](#) guide.
5. Review the opportunities for further partnership working and identify priorities for the coming year.
  6. Review the incentives, e.g. stickers, available to Team Leaders.
  7. Consider how to continue to involve Space Champions in supporting Team Leaders.

### *Conclusion*

Mission X is a successful cross-curricular challenge due to its flexible delivery model and the breadth and quality of materials available. Mission X positively impacts on participating young people and Team Leaders. Through the cross-curricular activities set in the context of training like an astronaut, young people develop their knowledge, confidence, and skills in relation to science and space. They are able to make connections with their own lives and consider the career options available to them. For Team Leaders there are a range of impacts. The majority are teachers in primary schools around the UK. Mission X provides content connecting physical activity, health and wellbeing to science. It improves the teachers' own knowledge, confidence and skills and provides a set of resources which can be used year after year. For parents who have engaged with the challenge during lockdown or who have been involved as home educators in previous years, the content is engaging and exciting for young people to participate in. Its flexibility is helpful to Team Leaders from uniformed groups such as Brownies, as they use the activities in-person and in an outdoor setting.

During the COVID-19 pandemic, Mission X was able to bring school cohorts together in a shared activity when the young people weren't able to mix in-person and it provided parents with creative and engaging materials to use at home with their own children.

In general, Mission X is an enrichment activity which can be used as a hook or connector to support the development of knowledge and skills across a range of areas. It can support the development of fitness, improve teamworking skills and raise awareness of potential space-related careers. There is an opportunity to build further on the success of Mission X by enhancing support for Team Leaders and developing links to careers guidance and other suitable resources.

## Introduction

This evaluation report reviews the Mission X delivery model and identifies areas of impact on young people and Team Leaders, before going on to make recommendations based on the findings.

Mission X is a STEM enrichment challenge for young people aged 8 to 12, led by the European Space Education Resource Office for the UK (ESERO-UK) at the National STEM Learning Centre. Teams participate in Mission X during a defined challenge period and gain points for each activity completed. Points are submitted online with the goal being the international ‘Walk to the Moon’ challenge to help the Mission X mascots to walk the distance between the Earth and the Moon. In normal years the challenge takes place January to May, but this was extended to July in 2021 due to the COVID-19 pandemic. The cross-curricular subject areas covered by Mission X include fitness, health and nutrition along with STEM-related space activities. The overall context drawing the activities together is that of “training like an astronaut”. A set of resources and supporting materials are available to Team Leaders. Team Leaders can register their group ahead of the January start or once the challenge has begun (they can register up until 6 weeks from the end of the challenge) and they are supported throughout the course of the challenge by an ESERO-UK Project Officer. There is then flexibility around how long and often the teams engage with the activities, with many being undertaken outside of the challenge period.

ESERO-UK have identified the following intended outcomes for the Mission X challenge:

- Increased confidence in learning science and working scientifically.
- Increased enjoyment and engagement in science.
- Increased knowledge of space.

The following section describes the methodological approach taken by the evaluation team.

## Methodology

The evaluation methodology used a Mixed Methods approach, combining both quantitative and qualitative methods. The approach was used to assess whether the intended outcomes were met and it also allowed for the identification of other impacts. Qualitative methods – primarily interviews – are particularly suited to the understanding of social phenomena.<sup>1</sup>

The following tools were used:

Item	Purpose	Description
Desk-based research.	To gather contextual information about the project.	This included examining previous evaluation reporting (especially the Mission X – train like an astronaut case studies from 2021), social media interactions, resource downloads, activity uploads from teams, registration numbers, a review of resource content and benchmarking against other inter-disciplinary projects (this included mapping the resources against the broad curriculum areas in the four nations of the UK).
Pre- and post- questionnaire analysis.	To establish an overview of the experience of the participants.	The survey analysis provided an overview of the level of activity of the teams and impact the project had on the participants.
Project team interviews.	To establish an overview of the project management roll out of the project delivery.	Semi-structured interviews were carried out with the ESERO-UK project team and the European Space Agency (ESA) International Space Station (ISS) and International Education Operations Coordinator who works with Mission X national co-ordinators across Europe.
Team Leader interviews.	To establish the impact on young people and the Team	Four interviews took place. Three were teachers and one

<sup>1</sup> Cohen, L., Manion, L. & Morrison, K. (2018) *Research Methods in Education*. 8<sup>th</sup> Edition. Abingdon: Routledge

	Leaders and to gain a greater understanding of what worked and what didn't.	was a parent (and also a primary teacher). The three teachers had previously participated for several years. The parent was new to Mission X in 2021.
Space Champion interview.	To understand the contribution of Space Champions to the project and their impressions of the impact on Team Leaders and young people. In the past Space Champions have been contracted to ESERO-UK in order to promote and support the use of space as a context in schools. This activity has included running activities with young people and continuing professional development (CPD) sessions for teachers. The contract arrangements have changed in this last year but they are continuing to promote opportunities and support work with schools.	One interview with a current Space Champion who has worked with a large number of schools over several years, beginning prior to Tim Peake's mission in 2015/16.
Stakeholder and partnership analysis.	To review which Mission X partnerships have brought the most value to the project and who the potential targets could be for future collaborations.	All previous partners and stakeholders were listed and categorised in order to identify opportunities for further connections.

Table 1. Tools used as part of the evaluation methodology

### Data analysis

Quantitative data from surveys and metrics were summarised using descriptive statistics whilst analysis of qualitative data will be undertaken using reflexive thematic analysis. This allows connections to be made between themes arising from the different sources of data<sup>2</sup>. The findings will be combined with the analysis of the quantitative data, with each being given

<sup>2</sup> Braun, V., Clarke, V. (2019) Reflecting on reflexive thematic analysis, *Qualitative Research in Sport, Exercise and Health*. 11:4, 589-597

equal weighting. In the following results and discussion session the quotes used are from interviews unless stated.

### *Ethics and GDPR*

Ondata Research LTD is registered with the Information Commissioner's Officer and carries out education research in accordance with the British Educational Research Association's code of ethics.<sup>3</sup> Participants were asked for their consent to hold data at each stage of data collection and they have the right to withdraw their consent at any time. Ondata's privacy policy can be viewed at <http://ondata.org.uk/privacy/>.

The following section describes the findings.

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<sup>3</sup> British Educational Research Association (BERA) (2018) *Ethical Guidelines for Educational Research*, fourth edition, London. Retrieved from <https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018>

## Results and Discussion

### Part 1. Impact of engagement with Mission X

This section addresses the evidence for Mission X achieving its intended outcomes for young people, and the impact of engaging with the programme more generally.

#### *Participating Teams*

There are a variety of different routes into taking part in Mission X. Some Team Leaders have been involved in Mission X for a number of years, having become aware of it as part of the Principia engagement programme during Tim Peake's mission to the International Space Station (ISS) in 2015/2016. Others have become aware of it through newsletter links or online searches. Originally led by NASA, Mission X is a well-established scheme and its popularity has grown, with a particular boost in participation following Tim Peake's Principia mission. This can be seen in the registrations over time, in Table 2.

<b>Year</b>	<b>Number of schools registered</b>
2012	37
2013	90
2014	95
2015	321
2016	625
2017	504
2018	360
2019	1056
2020	911
2021	430

*Table 2. Number of teams registered to participate in Mission X*

The growth in participation following 2015/2016 was also supported by the contribution of Space Champions who worked with schools to build on the interest in space kicked off by the Principia mission. One Space Champion interviewed recalled the enthusiasm of schools and how they were able to engage large numbers with Mission X as a result. The Space Champion introduced them to it, but the schools were able to go on and register and work independently on it. As would be expected, the number participating in 2021 has dropped due to the COVID-19 pandemic.

The underlying structure of the challenge allows for different levels of competition, all with the common goal of getting the mascots to the Moon:

- Individual challenge. For example, an individual young person working on the challenge by themselves in their own time.
- Group challenge. This could take place internally within a school or organisation, or externally in competition with other schools or organisations.

In 2021, there were 430 teams registered with Mission X in the UK and based on the data provided on points uploads only 38 teams (9% of those registered) recorded their activity on the Mission X website. A small number of teams were responsible for a high proportion of the recorded activity and one interviewee felt that for some teams seeing others recording points in the hundreds was slightly off-putting. There will certainly have been additional activity taking place which wasn't recorded, however as a direct quantitative measure, this aspect could be reviewed each year. The Space Champion interviewed was aware of many examples of schools using the Mission X materials but not necessarily registering for the challenge or recording their activities. One of the schools featured in the Mission X – Train Like an Astronaut Case Studies (2021) said they didn't submit points as *"the timings don't work for us as a school"*. The materials themselves have been made available in hard copy in previous years, and in different places online (including the TES and UK Space Agency websites). Therefore, there are likely to be resources being used around the UK on a repeat basis which won't be captured through recent registrations, downloads and page views.

Mission X fulfils a different purpose for the Team Leaders depending on their circumstances. Team Leaders are commonly primary school teachers, but they can also be parents or leaders of uniformed groups such as Scouts or Brownies and other groups. During the COVID-19 lockdowns in 2020, there was an increase in parents becoming involved as they looked for activities to do at home with their own children. Team Leaders had different motivations for becoming involved. For one teacher in particular, it was difficult to engage their pupils with exercise and they were looking for something with an extra hook. For another, they were delivering a space topic and working towards the Space Education Quality Mark (also delivered by STEM Learning), so they became aware of Mission X through this process. For a third teacher, they were looking for activities for a science week but due to lockdown they had to work on something over a longer period of time and they felt Mission X was very suitable for this.

One of the teachers interviewed has continued to use Mission X whenever they move schools. In their current school, it is used across multiple year groups starting with the youngest class and the teachers *"adapt it for them"*. A key motivation for adapting Mission X for a range of years is the interest the young people have in space: *"their need for space is so great"*.

## Resources

Feedback via the post-participation survey and interviews indicated there did not seem to be a strong preference for the PE-related activities over the STEM-related ones. Team Leaders used both and found the combination and breadth very useful in continuing to engage their young people over time. The PE-related activities tend to be easier to implement due to the limited equipment and background knowledge necessary. When reviewing the downloads of resources for 2021, the 'Astro Agility course' came top, with '26.2 with Tim' a close second. There was clearly an interest in resources related to Tim Peake as this activity had by far the most page views. See Table 3 for a summary of the top 10 most downloaded resources.

<b>Title</b>	<b>Total number of page views</b>	<b>Total downloads</b>
Agility Astro-Course	631	427
26.2 with Tim	1196	361
Peake Lift Off	403	313
What's Your Space Height	369	282
Building an Astronaut's Core	352	265
Do a Spacewalk	335	265
Touchdown Charlie	325	208
Base Station Walkback	341	202
Crew Assembly	257	201
Taste in Space	233	183

Table 3. Top 10 resources by downloads, January to June 2021.

There have been name changes to the resources over the years (for example 'Bugs in Space' has become 'Microbials') and this may have impacted on downloads as the names may be less accessible to those who have lower confidence in science. A full list of the ranking of the resources can be found in Appendix A. The majority of the most downloaded activities are PE-related but it could be that the PE activities are of a shorter duration to complete than the STEM-related ones, potentially explaining the split of downloads seen between the two categories. However, both were well received by the young people participating: *"The children in my class were really excited by the physical activities. The STEM activities, especially the ones involving food, were greatly received by the children"* (comment from post-participation survey). Additional experiments and activities were of interest to those responding to the post-participation survey and those who took part in the interviews. It is understood that the resources are under review and engaging titles, linking to astronauts where possible, with flexible differentiated content for different ages and abilities (especially extending to younger age groups), would be of most use to Team Leaders.

The resources themselves are of use to a range of different people and examples of the flexibility comes from one of ESERO-UK's Space Champions who has used aspects of the

resources with different audiences. They highlighted the potential for being creative with the resources and that you can extend and adapt them in imaginative ways. For example, the crew assembly resource recommends building a LEGO tower, but they have extended this to making up electric circuits whilst wearing bulky gloves. Although there was no officially-organised Mission X training for Team Leaders, there will have been some professional development for teachers led by Space Champions in their work when promoting ESERO-UK more generally. This role has of course changed in recent months and won't necessarily be able to support teachers with Mission X in the same way; however, there is the potential for the project team to offer more initial support to Team Leaders.

#### *Mission X during the COVID-19 pandemic*

In a period of uncertainty and difficulty during the COVID-19 pandemic, Mission X activities played a role in delivering curriculum-related content and ensuring young people took part in some physical activity. With the challenge activities already being available online, there was no adaptation required to allow the activities to be delivered in the changed circumstances due to lockdown. There were different ways in which Mission X was of value to Team Leaders (teachers and parents) during lockdown:

- One school was able to use Mission X with their whole rural school in order to teach science during lockdown as *"it was really hard trying to cover the curriculum with parents that had one computer"*.
- Young people were able to take part in the activities at home and then when they returned to school. It was *"quite inspiring to come back to it [Mission X] and really good to come back to a fun topic"*.
- The PE activities helped schools to ensure their pupils weren't just *"sitting at home"*. *"It was easy"* to combine different activities such as the 26.2 challenge, crab and crawl along with the Daily Mile to make up a regular PE slot at home.
- The flexible delivery model also meant it felt inclusive and brought different classes together at a time when they were being kept apart physically: *"It was great that we could run it throughout the school especially being in bubbles it gave us a feeling of being together despite not"* (comment from post-participation survey).

## *Impact on young people*

ESERO-UK have identified three intended outcomes for young people participating in Mission X. Each one is discussed in turn below.

### 1. Increased confidence in learning science and working scientifically.

In general, Team Leaders assessed impact on the young people in their team through observations of behaviour rather than in any other formal way. One Team Leader felt there was a clear increase in *“interest and awareness”* and *“understanding”* of the natural world. When it came to the impact upon their interest in relation to PE, one Team Leader felt their young people were *“challenging themselves physically and in ways that they never [had previously]”*. These comments were further supported by feedback from the post-participation survey. The following responses were given when the Team Leaders were asked about additional impacts on the young people participating: *“They learn about themselves and develop a sense of self-competition. Great for confidence building”* and *“They grew in confidence and enjoyed challenging themselves.”* This aspect was important to Team Leaders, and when asked to identify the main outcomes for the young people participating that they expected to see, this aspect was in the top 5 most common responses in both the pre- and post-participation surveys.

### 2. Increased enjoyment and engagement in science.

Importantly the young people taking part *“really enjoyed”* the activities and found them engaging: *“Children were very engrossed with the activities”* (comment from post-participation survey). Each of the aspects of Mission X combines to provide an enjoyable and engaging experience of science: *“The children are active and they're learning, and so there's a competition element to it as well.”* The opportunity for young people to influence the decision making, for example helping to decide what activities to do, was an important aspect which positively contributed to their enjoyment and engagement. For one Team Leader, they saw high levels of engagement and impact on young people with special educational needs. They observed positive engagement in the Mission X practical activities which they hadn't seen elsewhere. One of the Mission X – Train Like an Astronaut Case Studies (2021) described the positive impact on young people with special educational needs in more detail. This outcome relating to enjoyment and engagement ranked in the top three most common responses from Team Leaders in the pre- and post-participation surveys.

### 3. Increased knowledge of space.

The young people were able to improve their knowledge of space as part of their participation in the project. In the post-participation survey 14 out of 21 respondents indicated that their young people had an increased knowledge of space. Team Leaders were able to make connections between the activities and current news about the latest explorations (including William Shatner going into space aged 90) and their hobbies, such as astronomy. One of the Space Champions who has delivered Mission X in schools has seen the impact of connecting space with technology the young people see around them, for example in hospitals, and in general they felt that by supporting the development of their knowledge of space *“it helps us to understand the world around us”*. As with the other two previous outcomes discussed, this aspect ranked in the top two most commonly highlighted by Team Leaders in the pre- and post-participation surveys. Other key outcomes included to *“Improve pupil attainment or understanding in science”*, *“Increased pupil understanding of the importance of fitness, health and nutrition”* and *“Improved skills which are relevant to future STEM study or a career in STEM”*. A full list of the outcomes and their rankings from the pre- and post-participation surveys can be found in Appendix B.

#### *Impact on Team Leaders*

For Team Leaders, there were a range of impacts. For teachers, there was an opportunity for improved knowledge and skills with relation to space and STEM-related topics. For parents and carers, Mission X provided a wealth of easy to use cross-curricular resources. In general, the Team Leaders felt the resources were something they wouldn't come across elsewhere and would not have thought of doing themselves. Space Champions had an important role to play here to support teachers, which was described by the Space Champion who was interviewed: *“not only develop their [teachers'] ideas of how to do the project, but also develop their confidence”*.

The Team Leaders had a sense of space exploration having a broad impact on their own lives and those of the young people in their teams and felt this would only grow in the future as technology develops further and more places are explored. In summary, there was a perception of space exploration being important as it provided a progressive, technological and humanitarian development area for many people.

Team Leaders also had the satisfaction of seeing their young people *“being really happy and engaged”* with Mission X and appreciated that the activities and work that went on could be *“child-led”*. Mission X is highly regarded more widely in schools and, Team Leaders are excited about engaging with the project and this motivated them to participate in an interview about

their experiences. For those whose participation went on to incorporate multiple classes in a school, the Team Leader was an important supporting figure for their colleagues to help them build their confidence delivering the activities. The Mission X case studies provide detailed insight into the impact of participation on Team Leaders: *“This project gave me more confidence to lead science activities and I found that science could be fun and relevant”* (Team Leader quote from case studies). This impact extended to breaking down barriers between subjects: *“It enabled me to build up relationships with teachers in art, music, English and PE rather than purely in the science faculty”* (Team Leader quote from case studies). The opportunity for project management was another area of skills development for teachers.

## Part 2. Reviewing Mission X's delivery model

The key to the success of the Mission X delivery model is its flexibility. Team Leaders find it “easy” to sign up and access the resources. The cross-curricular activities are used with young people across a wide age range (year 5 is a common age group in schools) including those younger than the 8 to 12 years the resources have been developed for. With regards to workload, Team Leaders have found this “manageable” and for those working in schools the packs have been developed in such a way as to make it “easy to scale up, scale it down”. One teacher felt that it was necessary to have someone to “drive it” who is “passionate about space”, however there are many examples of Mission X supporting the development of this passion in teachers. Mission X is an opportunity for teachers to build their interest and passion about space. For example, one teacher described their journey: they talked about getting involved, having a go, seeing how it works for them and then in subsequent years adapting and adding to it. Through this process teachers themselves are building their confidence and knowledge of space and the Mission X activities.

In the post-participation survey, 19 out of 21 respondents said they would definitely run it again. The cross-curricular content was an important draw as its activities cover many aspects under the umbrella of space. The mix of content allowed for different activities to be carried out at different times and locations depending on the weather and the equipment available. For example, schools could do some PE activities outside when they couldn't necessarily access some of the equipment or resources needed for the science activities.

The feedback on the resources was very positive: “*The packs are really brilliant*”. They were felt to be well written and easy to understand or adapt. They fitted into the styles of their regular lesson planning with all the information they needed available to them. The teachers' guide was “*really good*” providing them with “*some background knowledge and how to deliver the activities*”. Team Leaders could choose activities which were relevant to them and “*you had that flexibility there and you could obviously take it as far as you wanted with the school or not*”. For the teacher interviewed who used it across their school, they were confident giving the resources to their nursery and PE colleagues who were non-scientists. The activities were felt to be suitable to return to and weren't just a one-off. The young people participating were keen to repeat activities to “*see if they could improve their scores*”. This also applied to the STEM challenges, as the young people could return to these following a period of research and access to other resources in school, such as their own vegetable garden.

The support provided to the Team Leaders by the project team at ESERO-UK was well regarded. Team Leaders felt they were quick to respond to queries and “*really helpful*”. The

ESERO-UK Project Officer is responsible for running the challenge. This involved promoting the challenge via different channels and setting up a system for registrations. Once teams were registered, the Project Officer communicated with them regularly over the course of the challenge period and was the point of contact for any queries. For the previous two years the responsibilities of the Project Officer also included managing the Mission X microsite hosted within the main STEM Learning website. This held all of the challenge resources, including those from other countries meaning the content being available in multiple languages. This hosting was an interim measure as the project shifted from being led by the National Aeronautics and Space Administration (NASA) to the European Space Agency (ESA) taking the main co-ordinating role. For the past two years this has meant the Project Officer's time has been largely taken up with dealing with the website; however, there is an opportunity for further development work to be undertaken as the website has now transitioned to ESA for the 2022 challenge. Space Champions have had an ambassadorial/promotional role since early on in the project's history. They highlighted the challenge to schools they worked with and as discussed in the previous section, also supported teachers in terms of CPD.

January to May is the time period when points can be uploaded for completing activities with the aim of helping the mascots 'Walk to the Moon'. Registration in the UK is open from September and there is flexibility as to when the activities can run, teams are not expected to wait until the 'Walk to the Moon' challenge period. In 2020 this challenge period was extended until the end of September and in 2021 it was moved until the end of July to allow for more at home activities to take place and be recorded. The expectation for 2022 is for a return to the January to May challenge period.

The pre- and post-participation surveys have provided some descriptions of those taking part and how they used the materials. However, these were small samples compared with the total number of registrations with 61 responses to the pre-participation survey and 21 responses to the post-participation survey. The following key points provide some helpful contextual information:

- Based on the responses, there was a high proportion of Team Leaders getting involved for the first time (almost 80% of respondents to the pre-participation survey had not taken part before). However, whilst this is a high proportion, it is clear from other evidence available that many teachers participate year after year without necessarily registering their involvement formally.
- Almost 80% of the Team Leaders were planning to use Mission X over a minimum of 4 weeks, specifically 4-6 weeks (around 40%), 7-9 weeks (around 26%) and over 10 weeks (around 13%).

- Around 48% of the respondents intended on taking part with young people aged 8 to 11 years. Only around 7% were intending to work with over the age of 11, with the remainder being made up of those aged 5 to 8, with around 6% intending to work with young people under 5 years.
- When asked how they intended to use the activities, twice as many respondents indicated they would work with an individual class or year group as opposed to the whole school (14.9% versus 6.9%). This tendency was further supported in the post-participation survey where around 80% took part with a class group (62%) or multiple classes and a whole year (18%), compared with around 20% where more than 100 young people were engaged.
- With regards to when the Mission X activities were run, science lessons were the slightly more commonly chosen slot compared with PE (22.7% versus 15.6% in the pre-participation survey, with similar responses in the post-participation survey).
- In terms of the background of the Team Leaders, nearly 70% were teachers (56.6% were classroom teachers and 11.1% were specialist PE teachers). Others were external providers (e.g. "PE club leader"), community group leaders or from families.
- When it came to reviewing the aspects of Mission X they engaged with, around 20% reported they had used the points calculator on the Mission X website. This provides further evidence that only a small sub-set of the activities being completed are recorded.
- There was very limited engagement with social media reported, with only one respondent in the post-participation survey indicating they had used the Mission X Facebook group.

Paid ads have been used in order to promote Mission X, and home educator Facebook groups were targeted in order to broaden participation. However, social media seems to have been used in a very limited way by participating teams and by the project in the UK and internationally to highlight activity during the 'Walk to the Moon' challenge period.

When the Twitter content linked to the Mission X hashtag and account was reviewed there were only a small number of posts and engagements. There is therefore a lot of scope to use this as a platform for sharing activity. It is recognised that the main Mission X account is led by ESA and there is therefore limited influence ESERO-UK could have. However, there could be more focussed activity via the ESERO-UK accounts. In particular there could be opportunities to add the Mission X hashtag to lots of existing content and posts, especially anything astronaut- or Tim Peake-related. One interesting example of use of social media is from [Maths Week Scotland](#). They regularly feature links to related content for participating schools, and are able to share examples of work done by schools when they tag the account in their own posts. Another good example of a challenge-related account is the [Big Draw](#). Participating teams in Mission X could be encouraged to share activity and it would be another

way to record activity, when teams are not uploading points or if they are taking part in activities outside of the January to May challenge period.

Team Leaders were asked to share any other examples of high-quality engagement schemes they had experience of. Mission X was very highly regarded and there were no other similar schemes mentioned. Team Leaders tended to share food and nutrition initiatives, with examples including [Eat like a champ](#) and [Rethink food](#) being shared, however this is drawn from a small sample who were interviewed. The Space Champion who was interviewed offered other ESERO-UK projects such as [Polar Ambassador](#) and [Climate Detectives](#) as good examples, however whilst these are cross-curricular activities they wholly sit within the STEM classification whilst Mission X connects to PE and health and wellbeing. In terms of engagement with other STEM Learning and ESERO-UK projects and initiatives, there was a reasonable level of uptake based on the responses to the pre-participation survey (provided in Table 4 below) but there was still a high proportion who had not engaged with anything previously:

Item	n	%
Space / STEM Ambassadors	16	17.0
Mission X	15	16.0
ESERO-UK resources, including space-themed resources on the STEM Learning eLibrary	14	14.9
Tim Peake Primary Project	8	8.5
ESERO-UK CPD	7	7.4
Climate Detectives	2	2.1
Space Education Quality Mark	1	1.1
None of the above	31	33.0

*Table 4. Responses to the question "Have you previously used any ESERO-UK resources before? If so which ones?" in the pre-participation survey*

A benchmarking exercise was undertaken by the evaluation team and this process identified a range of resources for a similar age group, however these tended to be one-off activities rather than sustained engagements or challenges. For example, CREST awards for this age group are offered as 'Discovery Days' where the challenge can be undertaken over the course of one day or structured as eight one-hour challenges. In contrast to the CREST awards for this age group, Mission X offers a set of cross-curricular activities within a broader context, whilst the CREST award activities are all science-related and cover a range of topics which aren't necessarily connected and the delivery of them is flexible.

Many activities available are often badged as being cross-curricular (or inter-disciplinary is the term used in Scotland) but seem to have limited connections between subjects and tend to link literacy and/or numeracy to another one or two subjects. There are many examples of topical science activities, where the content from the curriculum is placed in context.

With regards to the four nations of the UK, Mission X fulfils many of the different requirements within these curricula. Each is discussed briefly in turn:

- a. Scotland: Mission X resources fit well with the content and ethos of Curriculum for Excellence (CfE). Interdisciplinary learning is an important feature of CfE and the topics of health and wellbeing are priorities, along with STEM-related content.
- b. Wales: Mission X supports learners in working towards developing skills and knowledge for the Science and Technology Area of Experience and Learning for Curriculum for Wales. The new curriculum being introduced in Wales has an interdisciplinary focus, similar to CfE in Scotland.
- c. England: Mission X supports the 'working scientifically' aspect of the National Curriculum and topics such as Earth and Space section.
- d. Northern Ireland: the NI curriculum's relevant areas of learning include 'Physical Development and Movement', 'The World Around Us' and 'Science and Technology'. Cross-curricular content is an important focus for primary schools as they are encouraged to make connections between different areas.

One Team Leader summed up their experience of working with Mission X and why it was successful: *"Mission X has really got the handle on everything because it's got such a wide variety of things that you do. You can do some of it, you can do all of it, you can dip in and out. You don't have to do all of it in one go. That's really hit the nail on the head and made it really suitable, accessible to schools and has kept going for years."*

As part of the development of recommendations, a stakeholder and partnerships review was undertaken by the evaluation team. The main partners and groups are identified in Figures 1 and 2.

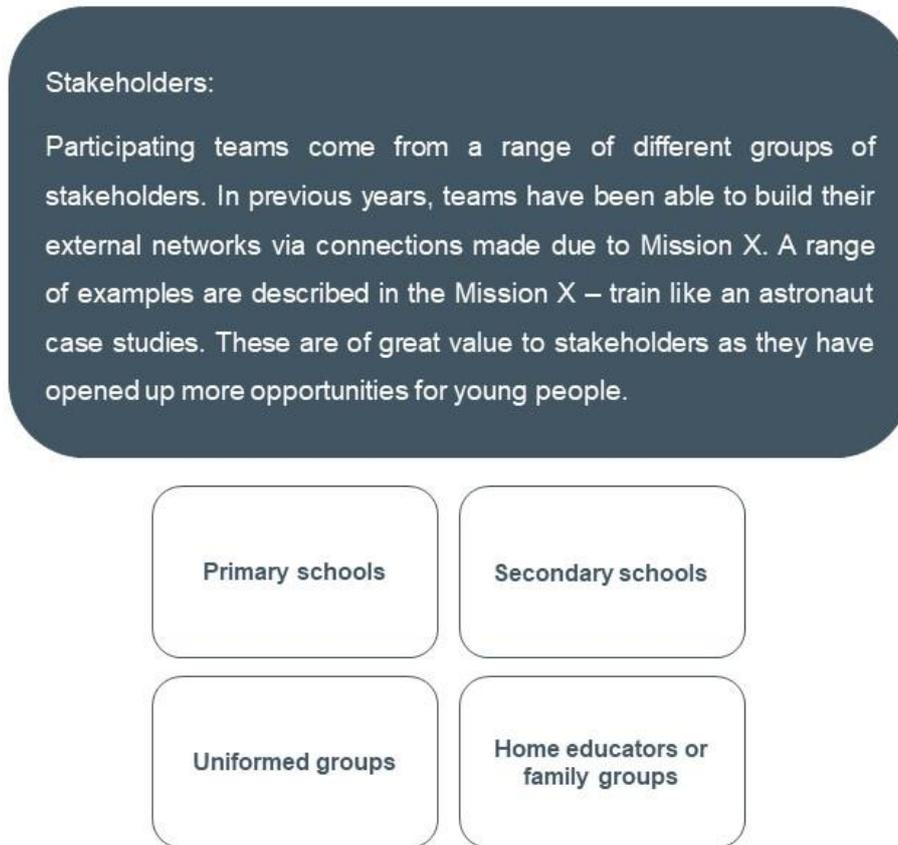
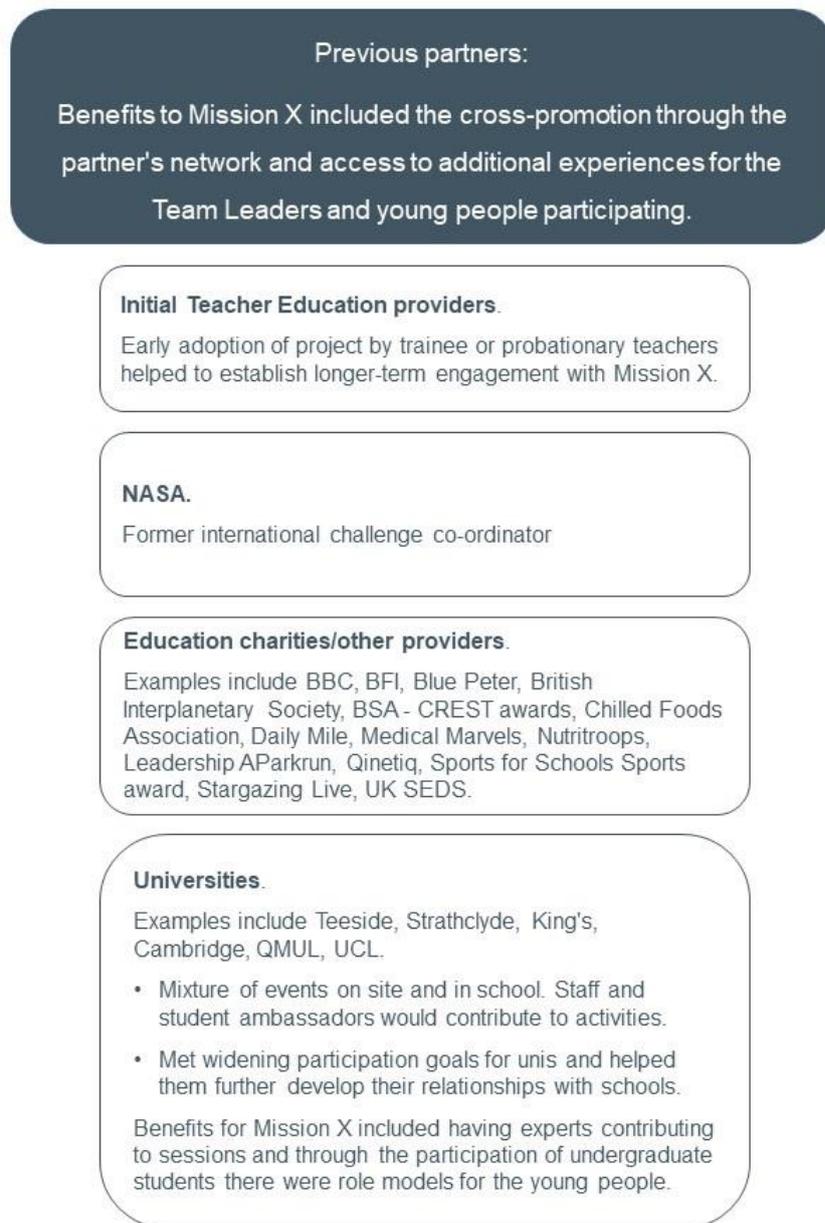


Figure 1. Stakeholder groups for Mission X



Figure 2. Key current partners for Mission X



*Figure 3. Previous Mission X partners*

There are many different potential partners and stakeholders for Mission X which could be engaged with over time. Previously, partners were keen to work with Mission X as the collaboration helped them to achieve their own goals (described in more detail in Figure 3). There are various examples of the impact of working with partners in the Mission X – train like an astronaut case studies. This included opportunities for international visits and chances to speak about their experiences at the House of Commons. Further work on this aspect is discussed in the following recommendations section.

### Part 3. Recommendations

This section outlines the recommended actions to build on the existing success of Mission X.

1. Establish a set of intended outcomes for Team Leaders (teachers, home educators and community group leaders to be described separately) to join those already existing for young people participating.
2. Develop an evaluation framework linked to the intended outcomes, identifying the range of available data to monitor and identify impact. This should include an exercise to describe different ways for teams to record and feedback activity that aren't solely linked to uploading points. E.g. social media posts, blog posts (a template could be provided), even a call to action for an end of activity 'Mission report' for the team to summarise what they've been doing and send to ESERO-UK. Additional areas of interest to record could include how they found out about Mission X and the importance of the international aspect of the challenge (for example, this was referenced in the case studies more than once and would be a useful avenue to follow-up on as this could help to identify further partnerships and impact). The pre- and post-participation survey questions should be reviewed to include questions closely linked to the intended outcomes (rather than including them as answer options in a multiple-choice question) and to include more open-ended questions to capture impact, particularly as Team Leaders are assessing impact on their young people. The open-ended questions could be helpful in identifying longer term impacts with Team Leaders who have been participating over several years. It would also be helpful to have more detailed information on how the Team Leaders perceive the points system and process (something which is also of interest to the ESA ISS and International Education Operations Coordinator).
3. Project Officer to dedicate time made available due to website oversight moving to ESA on expanding on the work done on relationship building with Team Leaders. This activity can encompass various aspects, outlined below.
  - a. **To support the running of the challenge and uptake of the activities, develop an expanded welcome pack for Team Leaders.** Build upon the welcome e-mail and the links to resources used in 2021 to include guidance on uploading points (Provide clear guidance on how to record points, e.g. are the points per person or per team? There was some dissatisfaction with the inconsistent approach taken by some teams to record their points. This highlights the competitive aspect of the challenge and the investment of the teams in their success) and other ways to share activities (e.g. what handles to include and any hashtags to use on social media). Potentially offer stickers as an incentive to upload points and share via social media. Include all links and information relating to the challenge in the first

e-mail, e.g. previously follow-up e-mails had included links to the Mission X YouTube playlist and 'Ask an Astronaut' films with Tim Peake. Team Leaders commented that they felt they might miss some content given the volume of e-mails received in general. Therefore, if one e-mail contained all of the relevant information, they could refer back to this. Follow-up e-mails could then highlight upcoming events or recent activity from other teams. Provide access to content from the Mission X case studies in order to illustrate the different ways in which the challenge can be used across different settings. Curate list of other projects and resources Mission X links to, use this as the umbrella and gateway for other activities. This would be especially helpful for those Team Leaders who have been using Mission X for multiple years. This list could include, for example, the wealth of resources established for the Principia mission, including the Principia Space Diaries, the Destination Space activities from the Association for Science and Discovery Centres, the Space to Earth Challenge and other projects such as EU Space Awareness and Our Space Our Future. There will be other UK Space Agency funded outreach schemes which could be highlighted to the Mission X participants.

- b. **Develop more explicit links to existing careers information.** There was interest from the young people to find out about STEM-related careers in the space industry. One Team Leader talked about how their young people were inspired by Mission X to consider a STEM-related career and that *"you don't want to necessarily go on into space, but what jobs are involved?"*. Team Leaders in schools tended to connect to STEM careers they were already familiar with, for example in one school astronomy was highlighted as a career opportunity as the school had their own telescopes. One Team Leader made an important point around the careers content needing to be realistic and not just talking heads: *"[young people] like to see what other people do for jobs and they like to have a nose around, you know, what do people do in labs? What do people do as engineers and see not just people talking about their job but actually see where people work"*. Team Leaders also made a request for diverse people to be featured, specifically *"young and funky"* rather than *"older and white"*. This need may have already been partially met via the "meet the expert" films highlighted by the ISS and International Education Operations Coordinator. There are existing examples, including from the EU-funded [Space Awareness](#) project.
- c. **Offer an optional training session or sessions for Team Leaders.** This could be a peer-led session where experienced Team Leaders shared experiences running the project in their setting. Team Leaders would find it helpful to know more

about the science and approach for the experimental activities, and how to support their young people in developing their own experimental skills. In the coming year, it is recommended that information and guidance from the Mission X case studies can be used to highlight the flexibility of the programme and ensure the voice of the Team Leaders is what comes through. This aspect of support was also highlighted as a priority by the ISS and International Education Operations Coordinator at ESA. The challenge period could also conclude with a get-together for Team Leaders in order to share what they have been working on. This would be a further opportunity for ESERO-UK to gauge impact and activity.

- d. **Aim to develop a peer-written guide for Team Leaders.** There are some very experienced Team Leaders who could share their experience of adapting and modifying the activities for a range of settings and age groups. The key strength of Mission X is its flexibility and showcasing this through a guide would solidify this further. This should also incorporate an emphasis on the potential for multi-year participation. Many STEM-related engagement projects are one-offs and Team Leaders are more likely to invest their time if they know they are able to build on their experience year on year by adapting and adding to what they are doing. In earlier years, Mission X CPD was targeted to newly qualified or probationary teachers, helping to build confidence from early in their careers and encourage year on year participation. There are many adaptations made by teachers which have been tried and tested with teams. ESERO-UK could collate and share a sample of these for Team Leaders to use, rather than having to make their own. This celebrates success and enables teachers to use something someone working with the same age group had already created or to adapt it to their age group.
- e. **Increase the advice and guidance available for those working with young people aged 8 and under.** A significant proportion of the Team Leaders intended to work with younger age groups, and based on the feedback from Team Leaders, there are resources and adaptations which have been made, so seek out examples of these and share with others. This guide could also include a press release template for schools who want to submit something to their local newspaper.
- f. **Maintain a calendar of events which Mission X could be tied into.** For example, the Commonwealth Games in Birmingham in 2022 and the regularly held World Space Week in October of each year. The activities and resources are available for Team Leaders to use whenever suits and the challenge period motivates teams to complete activities and upload their points. However, there could be opportunities throughout the challenge period to encourage teams to take part in the same activities at the same time culminating in a webinar or joint event. The



Learning. Then in England there seems to be a particular opportunity to extend the age range of the Mission X materials, as there is guidance around year 3 learners being expected to find out about food and nutrition and be introduced to basic ideas around skeleton and muscle movement and development.

- b. **Review the resource formatting and file types available.** Some Team Leaders mentioned an inconsistency in some of the formatting and design between the resources. This seems to be down to the availability of the resources in certain formats. For example, one teacher talked about the awkwardness of using the PDF of the Activity guide to introduce an activity to their class when a PowerPoint would have been more helpful. ESERO-UK could make the resources available in multiple formats to allow for easy display and use.
  - c. **Revisit the Tim Peake-related activities.** There are also some activities relating to Tim Peake which could benefit from a refreshed approach, as they focussed on him being in space. For example, one teacher saw an opportunity for the 26.2 activity to be revisited as part of a shared event. The context for the activity was around Tim Peake completing the marathon in space and the impression the teacher had was that it had been kept in the resources list *“because it was good”* but they felt it was a bit odd to be repeating it when Tim wasn’t in space.
  - d. **Collate activities suitable for delivery in an outdoor setting.** In order to be inclusive regardless of whether individual young people have access to devices and an internet connection, ensure the activities and resources are available digitally and also in hard copy where possible. For example, uniformed groups such as Brownies tend to run activities outside or in locations where there isn’t necessarily an internet connection or audio-visual facilities available. Alternatively, a parallel pack focussed around delivery in outdoor settings would be well received.
  - e. **Highlight Mission X as inclusive for young people of all abilities.** For example, one Team Leader appreciated having the suggested adaptations as it meant they were able to include all young people in their class.
  - f. **Include Mission X on STEM Learning’s [cross-curricular topic pages](#) and on pages such as the [Year 5 Earth and Space guide](#).** There could be one section on Mission X itself, highlighting the physical and science-related resources.
5. There are many opportunities for further partnership working. In previous years, partners have supported end of challenge events and activities for teachers, such as a visit to Qinetiq to see and experience their centrifuge. Experiences which link closely to the activities and the training of astronauts have been very well received in the past. This supports further confidence-building of teachers and they are likely to continue to use the Mission X activities, not just in the challenge period but elsewhere in their teaching. In

2022, this could be related to the consideration of an in-person closing event (or events), in a format to be determined by ESERO-UK. If in-person, it would need to be fully funded but this could mean in-kind support provided by partners local to participating teams, minimising cost and maximising impact. Other potential partners could help with promotion of Mission X, for example the Ogden Trust, Primary Science Teachers Trust, Big Science Share and the Association for Science Education.

6. Team Leaders who have been involved for several years miss having the stickers to hand out as rewards and incentives to young people. Mascot cut outs and other aspects relating to the Mission X branding could be used by schools in displays. In addition, supplying some of the more unusual props (for example urine sample pots) would be helpful. Another option would be making copies of relevant books available to schools (e.g. ones by Tim Peake, Principia space diaries). These could be given out to teams with the highest points or ones who have been posting about their activity on social media or via a blog post.
7. Space Champions have been an important link to Team Leaders and teachers as they have supported Mission X through teacher CPD, in particular helping to build confidence of those teachers who are more uncertain about space. Consider how to mitigate this with their change in roles and whether there is a way to keep them involved and supporting schools, particularly those who are new to the challenge and who could use some additional support. E.g. involving them in the teacher CPD and collating and curating resources from previous years.

## Conclusion

Mission X is a successful cross-curricular challenge due to its flexible delivery model and the breadth and quality of materials available.

Mission X positively impacts on participating young people and Team Leaders. Through the cross-curricular activities set in the context of training like an astronaut, young people develop their knowledge, confidence, and skills in relation to science and space. They are able to make connections with their own lives and consider the career options available to them. For Team Leaders there are a range of impacts. The majority are teachers in primary schools around the UK. Mission X provides content connecting physical activity, health and wellbeing to science. It improves the teachers' own knowledge, confidence and skills and provides a set of resources which can be used year after year. For parents who have engaged with the challenge during lockdown or who have been involved as home educators in previous years, the content is engaging and exciting for young people to participate in. Its flexibility is helpful to Team Leaders from uniformed groups such as Brownies, as they use the activities in-person and in an outdoor setting.

During the COVID-19 pandemic, Mission X was able to bring school cohorts together in a shared activity when the young people weren't able to mix in-person and it provided parents with creative and engaging materials to use at home with their own children.

In general, Mission X is an enrichment activity which can be used as a hook or connector to support the development of knowledge and skills across a range of areas. It can support the development of fitness, improve teamworking skills and raise awareness of potential space-related careers. There is an opportunity to build further on the success of Mission X by enhancing support for Team Leaders and developing links to careers guidance and other suitable resources.

## Appendix A – Full list of resource downloads in 2021

<b>Title</b>	<b>Total number of page views</b>	<b>Total downloads</b>
Agility Astro-Course	631	427
26.2 with Tim	1196	361
Peake Lift Off	403	313
What's Your Space Height	369	282
Building an Astronaut's Core	352	265
Do a Spacewalk	335	265
Touchdown Charlie	325	208
Base Station Walkback	341	202
Crew Assembly	257	201
Taste in Space	233	183
Mission Control	166	155
Crew Strength Training	259	146
Microbial Box 1	224	145
Energy of an Astronaut	180	129
Jump for the Moon	151	125
Space Rock-n-roll	155	119
The Speed of Light	156	115
Microbial box 2 – What's in your Petri?	176	114
Hydration Station	121	101
Planet you go, Gravity you find	154	97
Explore and Discover	144	96
Living Bones, Strong Bones	100	74
Reduced Gravity, Low Fat	113	65
Let's Climb a Martian Mountain	114	63
Get on your Space Cycle	86	52
Mission Journal Student Logbook	21	4
Welcome Guide for Teachers	13	0

*Table 5. Mission X resource downloads and pageviews – English resources only*

## Appendix B – Outcomes of participating in Mission X

- Pre-participation question: What are the main outcomes you aim to achieve by engaging with Mission X? Sample size of 61.
- Post-participation question: “Which of the outcomes below do you believe were achieved by engaging with Mission X? Please select all that apply”. Compared with the pre-participation survey, the available responses were the same except for one addition: “Improved skills which are relevant to future STEM study or a career in STEM”. Sample size of 21.

Outcome	Pre			Post		
	n	%	Rank	n	%	Rank
Increase pupil knowledge of space	53	86.9	1	14	66.7	2
Increase pupils' enjoyment and engagement in science	47	77	2	13	61.9	3
Improve pupil attainment or understanding in science	44	72.1	3	6	28.6	9
Increase confidence in learning science and working scientifically	43	70.5	4	8	38.1	7
Increase pupil understanding of the importance fitness, health and nutrition has for astronauts	38	62.3	5	15	71.4	1
Provide opportunities for cross curricular learning using the context of space	36	59	6	6	28.6	11
Increase pupil understanding of the importance of fitness, health and nutrition.	35	57.4	7	12	57.1	4
Increase pupils' overall fitness levels	29	47.5	8	8	38.1	8
Increase science capital of pupils	26	42.6	9	9	42.9	5
Improve teacher confidence in teaching space topics	25	41	10	4	19	14
Provide an exciting context for PE lessons	25	41	11	6	28.6	10
Raise the profile/priority of science within school	20	32.8	12	5	23.8	13
Sharing of effective practice and resources	17	27.9	13	3	14.3	15
Improve pupil concentration in lessons	9	14.8	14	5	23.8	12
Improve pupil behaviour in lessons	7	11.5	15	1	4.8	16
Improved skills which are relevant to future STEM study or a career in STEM	N/A	N/A	N/A	9	42.9	6

Table 6. Pre- and post-participation survey responses relating to outcomes for young people participating in Mission X

The Mission X evaluation was undertaken by Laura Thomas, Clare Meakin and Heather MacRae.

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, museums, education charities, universities and professional bodies. She is undertaking research relating to professional development of teachers after having recently completed an MRes in Educational Research with the University of Stirling. 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.

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.

Heather has had an extensive career in education, careers and STEM engagement. She has an MBA and significant experience as Chief Executive of the Ideas Foundation, a charity aimed at supporting underrepresented communities and understands the challenges of governance, and managing programmes with multiple stakeholders in a dispersed geography. Heather has an MA in Careers Education and Guidance and an excellent understanding of how the Mission X programme can contribute to wider education initiatives. Heather has worked as a consultant to the UK Space Agency, developing two successful projects for Principia: the Principia Space Diaries and the Space to Earth Challenge. She regularly collaborates with multiple partners through her consultancy, Venture Thinking. Heather has worked as a technical expert for the EU for over five years, evaluating international space education initiatives. Heather has worked in the past with BBC Stargazing Live and Blue Peter/Newsround on promoting exploration education.



Ondata Research

Ondata Research LTD 10 Douglas Terrace, Stirling, FK7 9LL  
info@ondata.org.uk www.ondata.org.uk 07887920426

Company number: SC621169 (Registered in Scotland)