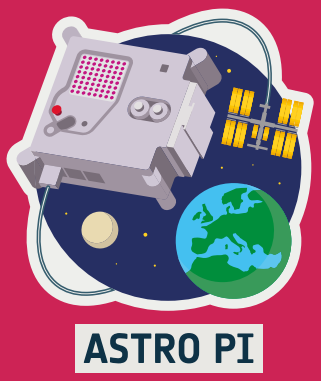
Raspberry Pi Foundation

Astro Pi 2024/25

Impact report



Introduction

The European Astro Pi Challenge is a collaboration between ESA, the national European Space Education Resource Offices (ESEROs), and the Raspberry Pi Foundation. It offers young people the amazing opportunity to learn how to code and conduct scientific investigations in space, by writing computer programs that run on special Raspberry Pi computers, called Astro Pi computers, on board the International Space Station (ISS). The Astro Pi Challenge is open to young people up to age 19 in ESA member and associate countries. Each year, there are two challenges: Mission Zero and Mission Space Lab.

Mission Zero offers students and young people the chance to have their code run in space on the ISS. Teams write a simple program to take a reading using a sensor on one of the ISS Astro Pi computers and display a personalised picture.

In Mission Space Lab, teams are invited to write programs that solve a specific challenge: to measure the speed that the ISS is travelling as accurately as possible. To achieve this, teams can use the Astro Pi computers' range of environmental sensors (SenseHAT) and camera to gather data about the orientation and motion of the ISS as it orbits the Earth. Teams are awarded 'flight status' once we have made sure their programs work and adhere to the mission guidelines.

Along with a summary of participation, this impact report aims to understand the extent that mentors felt equipped to support their teams, and the difference participation in the Astro Pi Challenge made to young people's lives. To answer these questions, we collected data through multiple sources.

- **Registration forms:** We tracked data from team registration forms filled out by mentors
- **Post-submission surveys:** We surveyed mentors whose teams submitted computer programs
  - Mission Zero: 99 mentors (8%) responded
  - Mission Space Lab: 26 mentors (14%) responded
- **Non-submission surveys:** We specifically surveyed mentors whose teams registered but did not submit code to learn about barriers to completion
  - Mission Space Lab: 55 mentors (34%) responded
- **Interviews:** We conducted in-depth interviews (in groups or individually) with mentors to gather richer, contextual insights
  - 4 mentors were interviewed for Mission Zero
  - 1 mentor was interviewed for Mission Space Lab

Who took part?

27,247 young people took part from **27 countries**.

26,294 young people had their code run in space!

Mission Zero

17,295 teams took part, an **8%** increase from 2023/24. Of these, **17,109** teams' submissions **(99%)** were eligible to run on the ISS.

25,405 young people participated, with **44% of them identifying as female**, 52% as male, 1% preferred to self-describe, and 3% preferred not to say.

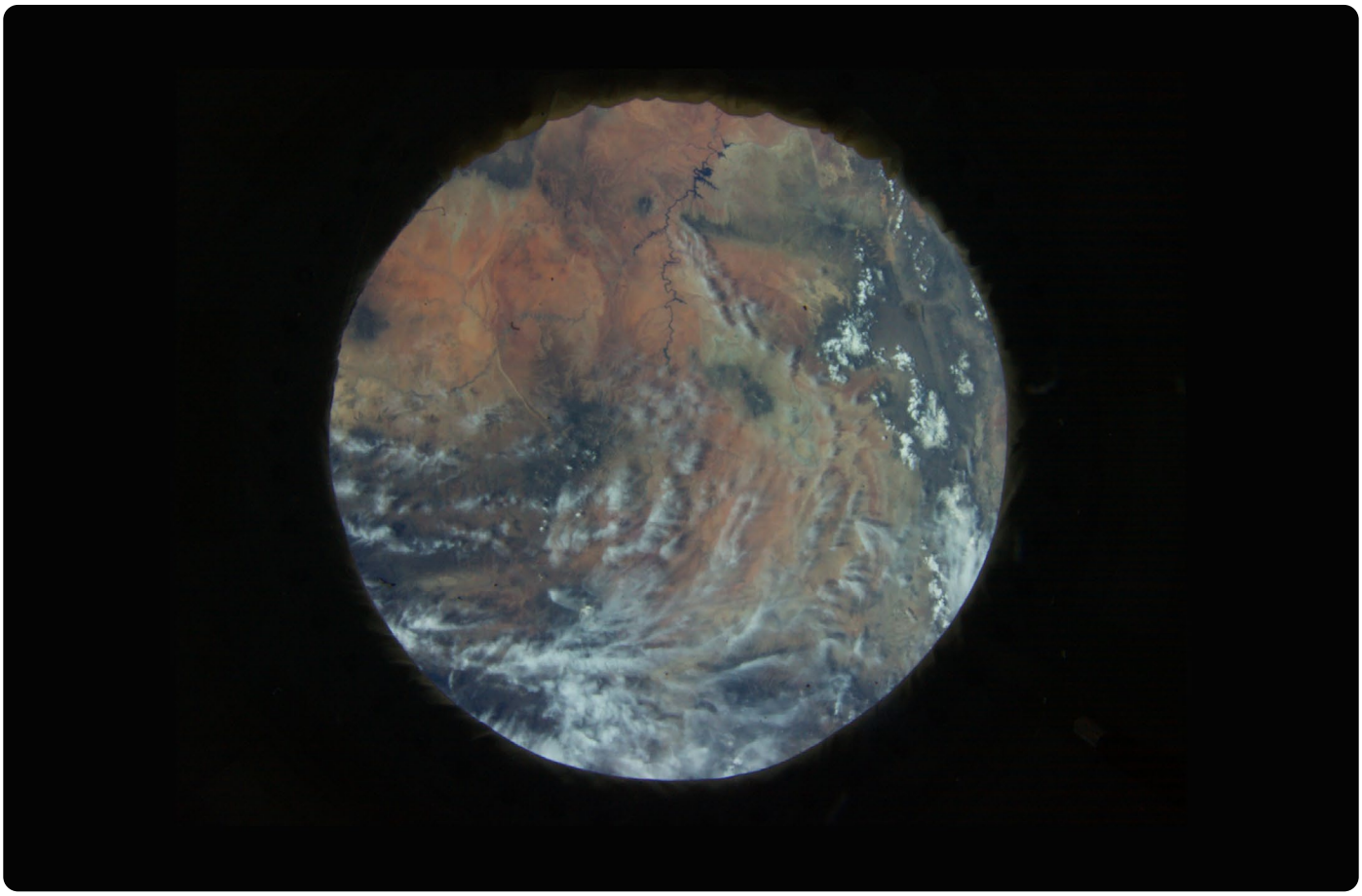
They represented **27 countries** and had an average age of 12 years.

Mission Space Lab

544 teams registered, with **57% achieving flight status** (a **15% point increase** from 2023/24 in the proportion of teams achieving flight status).

1,842 young people were registered, with **27% of them identifying as female**, 69% as male, 1% preferred to self-describe, 1% preferred not to say, and 1% identified as other.

They represented **24 countries** and had an average age of 15 years.

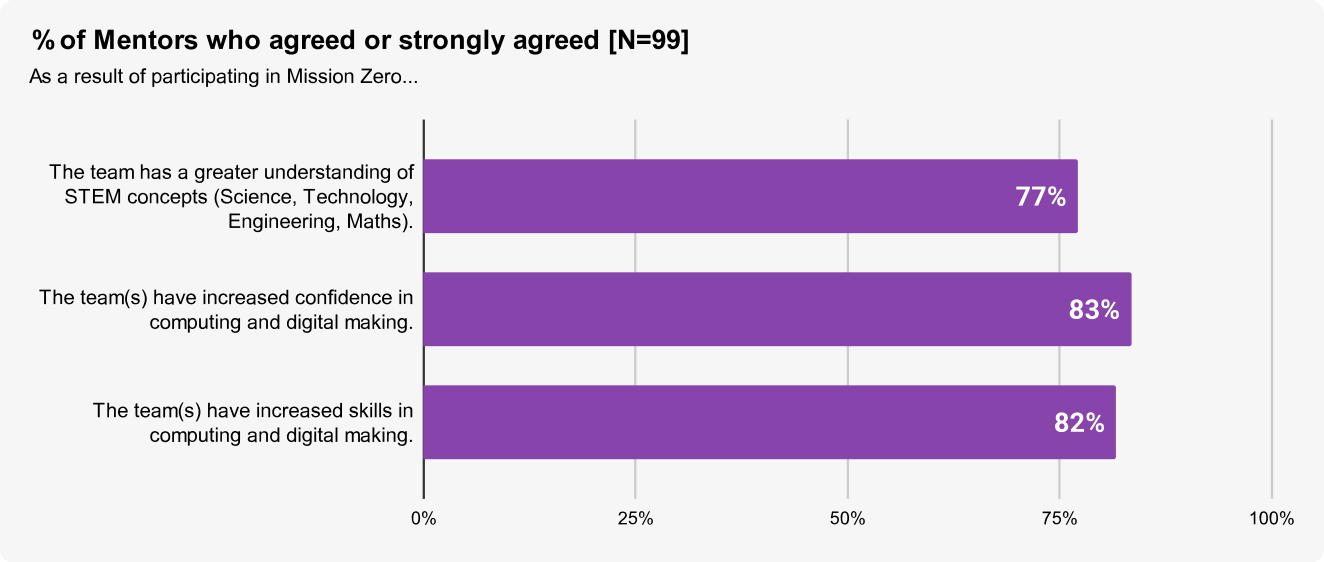


↑ Glen Canyon in Utah, USA, taken by a Mission Space Lab team

Impact: Mission Zero

Knowledge, skills, and confidence

Mentors found Mission Zero to be a **great entry point** for young people to writing computer programs using Python. The challenge's real-world connection to space and its low-stakes nature made it an ideal learning environment. Mentors further confirmed this in the post-submission survey, with 83% agreeing that young people increased their skills and confidence in computing and digital making as a result of their participation this year.



In focus groups, mentors highlighted that participating in Mission Zero **empowered young people**, many of whom came from educationally disadvantaged areas. The programme not only increased their confidence, but also helped young people **feel connected to a wider community** of learners around the world.

"I think Mission Zero is a way of connecting not only to a worldwide group of learners, but also to explorers, future scientists, and future astronauts. To see them as part of a larger community and not just an activity or assignment that they have to do in class. They discover their own abilities and potential, and exercise their creativity in a very low-stakes environment and then to see it come to life in that global way is extremely valuable."

Mission Zero mentor

"They [young people] come from complicated environments and sometimes their confidence is very low. They don't believe in themselves and this [Mission Zero challenge] really empowers them."

Mission Zero mentor

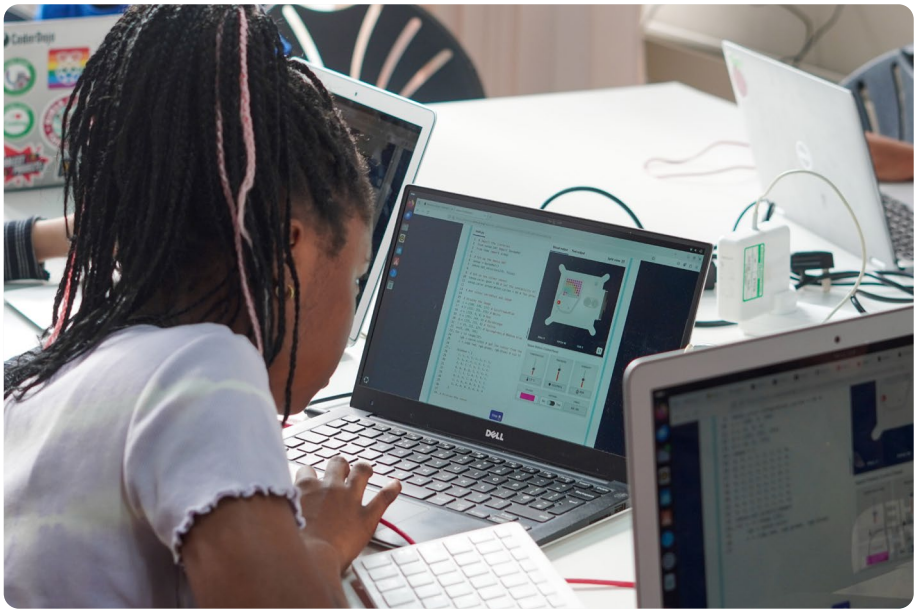
Continued learning

These positive early experiences with Mission Zero are also likely to **encourage further engagement and learning**. 78% of mentors believed that it was likely or very likely that the young people they supported will participate in other computing and digital making challenges in the future.

One mentor highlighted that while it is hard to isolate impact from other engagements, they received news about former students participating in other coding competitions.

"I got some feedback on students [I mentored]... and a teacher shared that they met them in a coding contest and they were participating there. So I felt, this is really great because I know that I helped plant the seed and now they're participating in coding contests and doing stuff with coding."

Mission Zero mentor



↑ A young person coding Mission Zero

Impact on the community

Like previous years, Mission Zero continued to generate interest from the wider community. Nearly 60% of mentors reported that their team's participation in Mission Zero led to **other mentors or young people becoming interested** in taking part in the future. They described how the challenge sparked the interest of parents and carers, who were impressed by their children's engagement during the challenge.

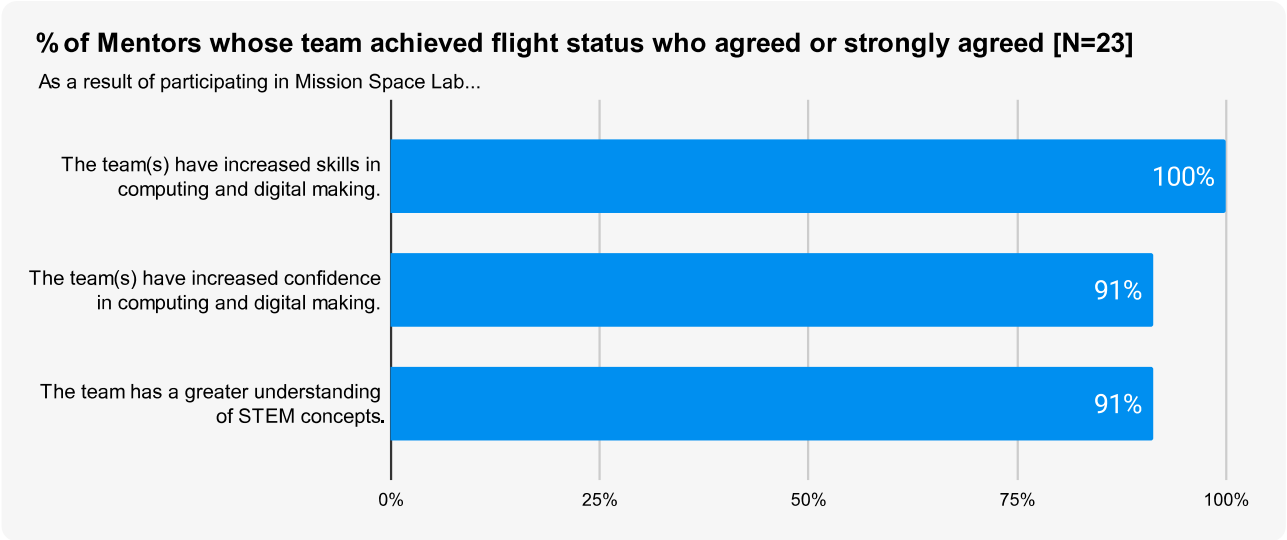
"They were wondering what their peers were doing, like 'What are you making over there?' A few of them got interested as well. So definitely there's some interest on that part from the students. They would like to participate [in Mission Zero] as well."

Mission Zero mentor

Impact: Mission Space Lab

Knowledge, skills, and confidence

100% of mentors we surveyed told us that young people who successfully completed the Mission Space Lab challenge had **increased their skills in computing and digital making** as a result of taking part. This also had an **impact on their confidence**, with 91% mentors confirming that in the survey. The challenge engages young people in combining knowledge from other scientific domains and the impact is likely to extend beyond just computing as highlighted by mentors.



Continued participation

Mentors highlighted that the mission gave young people an **experiential understanding** of how technology and computing are applied in the space industry. This direct link to the real world likely inspires further engagement. 91% of mentors told us that young people who successfully wrote code for Mission Space Lab were likely or very likely to participate in computing and digital making challenges in the future.

> **"Some of my students, after moving on to secondary school, implemented Astro Pi [Mission Space] Lab in their new school and felt encouraged by their [Astro Pi] activities in primary school."**
>
> *Mission Space Lab mentor*

Impact on the community

As in previous years, the Mission Space Lab challenge continues to engage the wider community and create a ripple effect. 72% of mentors said their teams' participation led to other mentors or young people becoming interested in taking part in the future.

The connection to space and the ISS is inspiring

As mentioned previously, the real-world application of the challenges, their connection to space and the International Space Station continue to be strong motivators, not just for young people but also mentors. In the survey, 90% of mentors in Mission Zero and 92% in Mission Space Lab reported that the young people participating were highly motivated by the possibility of having their code run on the ISS. In interviews and free-text responses in the survey, mentors highlighted how the **excitement of working on a space project** extended to them and other adults in their community too.

"They've always really enjoyed the sheer fact that you get to send stuff into space because it is really cool."

Mission Zero mentor

"You know, even the adults I tell about this say, 'Oh, that sounds amazing. Can I do it?' I go, 'No, you're too old. I'm too old.'"

Mission Zero mentor

"We want our code to run in space! We are fascinated by discovery and the opportunity to contribute to a real science experiment on the ISS."

Mission Space Lab mentor

"Our passion for space exploration inspired us to join the Astro Pi Challenge to contribute to space research."

Mission Space Lab mentor

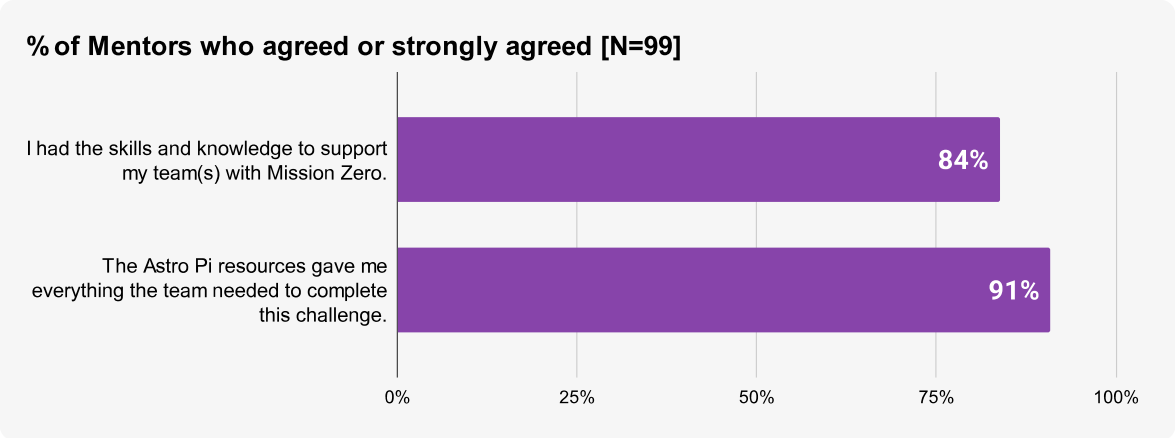
↑ ESA project astronaut Sławosz Uznański-Wiśniewski

Mentors' experience: Mission Zero

What worked well?

Mentors and young people had a highly positive experience participating in Mission Zero. 98% of mentors said their teams somewhat or very much enjoyed taking part. 78% of mentors rated it highly likely (9 or 10 on a 10-point scale) that they would recommend Mission Zero to a friend or colleague.

Mentors are crucial to ensuring the challenge is successful and they often come from diverse backgrounds. To make sure they feel prepared and supported, we provide comprehensive guidance and resources. 91% of mentors agreed that the resources this year gave them everything they needed to complete the challenge, and 84% of mentors felt they had the skills and knowledge to support their team.



"I had no [prior] skills, but the support proved to be excellent."

Mission Zero mentor

"Step-by-step instructions were excellent and really clear. Very easy to follow."

Mission Zero mentor

What could be improved?

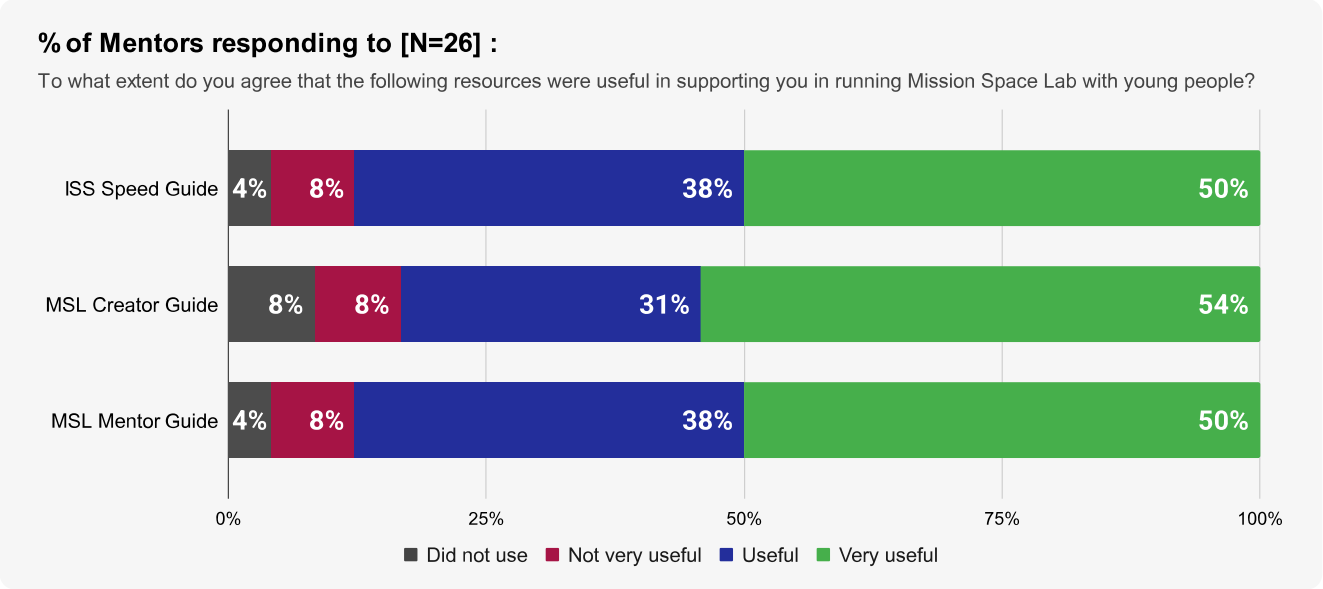
While the support provided was highly rated, some mentors noted a need for more clarity on the challenge's open-ended nature. They also suggested providing more creative prompts to make young people aware they can create their own artwork.

Mentors' experience: Mission Space Lab

What worked well?

Like Mission Zero, mentors and young people had a highly positive experience with Mission Space Lab. 100% of mentors stated that their teams somewhat or very much enjoyed taking part.

Mentors found the provided resources to be really effective. Between 80% and 90% of mentors found the guides and online tools provided to be very useful for successfully running the program and troubleshooting problems.



"We faced some difficulties working with the Python libraries, as we couldn't match our Raspberry Pi with the exact same version as the ISS. Fortunately, the simulator [Astro Pi Replay online] provided by your team helped us fine-tune the code."

Mission Space Lab mentor

What could be improved?

While the feedback was mostly positive, some survey respondents suggested a need for more simplified, step-by-step instructions for less experienced learners.

To understand how we can further support teams, we also surveyed mentors from teams that registered but did not submit code. In the 55 responses we received, the main reasons highlighted for non-submission were a shortage of time due to other school commitments, and their teams finding the challenge difficult.

Next steps

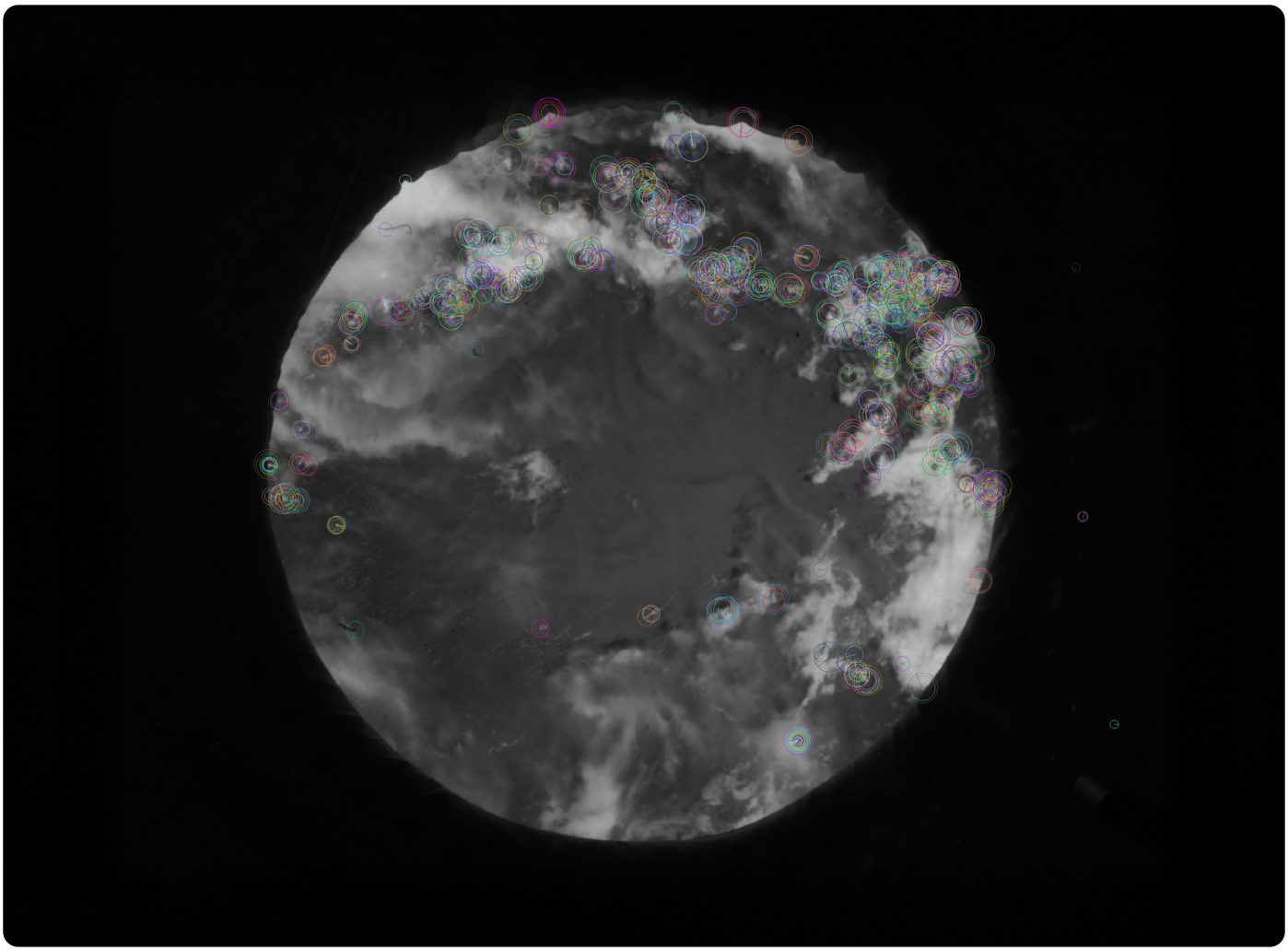
We are continuing to reflect on how we can build on the success of the Astro Pi Challenge 2024/25, and how we can make the experience even better for young people and mentors. Building on mentors' feedback, we have already started to make changes for Astro Pi 2025/26 to improve the experience:

Mission Zero

We have updated the project guide to further emphasise the open-ended nature of the challenge and added links to additional creative coding tasks for young people to work on once they have completed Mission Zero.

Mission Space Lab

We have improved the error messaging of the testing tool for teams, Astro Pi Replay, increased its efficiency, and enabled an offline mode as a web app. These are designed to help teams identify any issues with their programs, and those testing their programs on low bandwidth connections.



↑ An image taken by a Mission Space Lab team that uses feature extraction

Conclusions

The data herein suggests that the Astro Pi Challenge continues to make a powerful, positive difference to young people's lives. Mentors told us that both challenges increased young people's skills and confidence in computing and digital making. While Mission Zero proves to be a motivating early experience for young people to text-based programming, Mission Space Lab provides an interdisciplinary scientific challenge that develops advanced technical skills and wider knowledge of STEM subjects.

For young people who come from areas of educational disadvantage or underrepresented groups, participating in the Astro Pi Challenge makes them feel more confident and connects them with a wider community of learners from around the world.

Both challenges are likely to inspire young people to continue participating in other competitions and learning experiences related to new and emerging technologies. The space theme encourages conversations about the real-world applications of technology, and knowing their programs will run in space brings a sense of excitement for both young people and the adults that support them.

Overall, young people had a really positive experience participating in the Astro Pi Challenge according to nearly all mentors we surveyed. These positive experiences also pique the interest of participants' peers, who want to get involved and join in, as well as increasing engagement with parents and the wider community.

Raspberry Pi
Foundation

www.raspberrypi.org