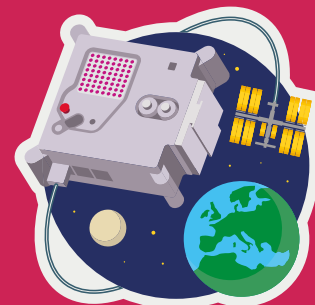


Astro Pi 2023/24

Impact report



ASTRO PI

Introduction

The European Astro Pi Challenge is an ESA Education project run in collaboration with 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 Raspberry Pi computers on board the International Space Station (ISS). The annual 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.

In Mission Space Lab, teams of young people work together to create computer programs that run a scientific experiment on the ISS. This year's task was to calculate the speed of the ISS. Teams are awarded 'flight status' once we have made sure their programs work and adhere to the mission guidelines and then their programs are sent to run on one of the two Astro Pi computers on the ISS: space-adapted Raspberry Pi computers with cameras and a range of environmental sensors.

In Mission Zero, young people write a simple program that displays a pixel art image they design. The program takes a reading from the colour and luminosity sensor on an Astro Pi computer on board the ISS, and uses this reading to set the background colour of the image, which the astronauts can see as they go about their daily tasks.

To evaluate the reach and impact of the 2023/24 Astro Pi Challenge, we collected data through:

- Online registration forms
- End of project surveys
 - 56 mentors (15%) completed the survey for Mission Space Lab
 - 135 mentors (11%) completed the survey for Mission Zero
- Focus groups
 - 8 focus group attendees for Mission Space Lab
 - 10 focus group attendees for Mission Zero

Who took part?

Mission Space Lab

564 teams registered, with **42% achieving flight status** (an **increase of 4% points** in the proportion of teams achieving flight status).

2,008 young people registered, with **889 young people achieving flight status**. They had an average age of 15 and 28% identified as female.

They represented **25 countries**, with young people from **22 countries achieving flight status**.

“It brings something that is an idea – It’s space – It’s so far away – It’s a theoretical idea. But with your project, they managed to make it something of their own... a part of their everyday life.”

Focus group attendee

Mission Zero

16,039 teams took part, a **3% point increase** from 2022/23. Of these, 15,942 teams’ submissions (99%) were eligible to run on the ISS.

24,663 young people participated. They had an average age of 12 and **44% identified as female**.

“The children and teenagers are very interested in space exploration. The idea of sending a piece of code to space is very exciting for them.”

Focus group attendee

“ ...they get part of the real world when they are in school... it is going to go to [the] space station... so they see something that’s been in the real world comes back to them.”

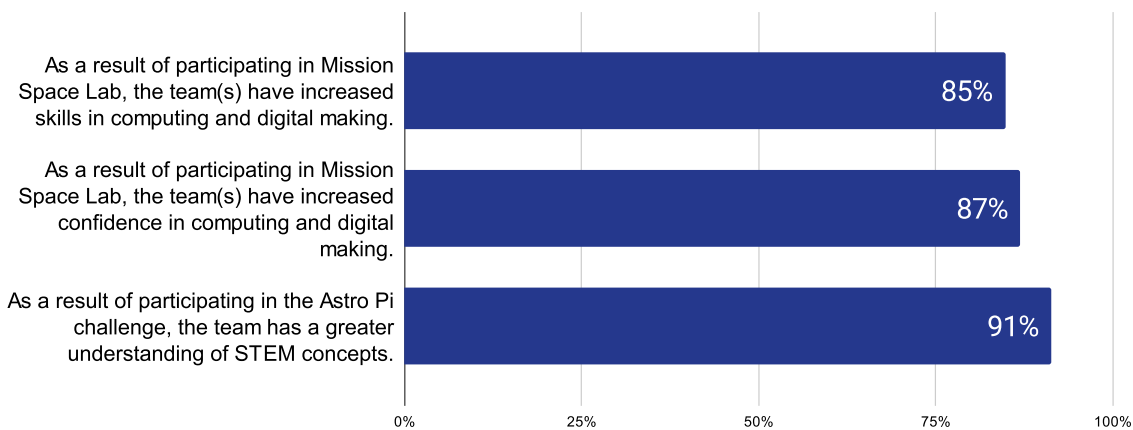
Focus group attendee

Impact: Mission Space Lab

Skills

91% of mentors told us that young people who successfully wrote code for Mission Space Lab had a **greater understanding of STEM concepts** (science, technology, engineering, maths) as a result of taking part in Mission Space Lab. 87% agreed that young people increased their confidence and 85% agreed that young people increased their skills in **computing and digital making**.

% Mentors whose team achieved flight status who agree or strongly agree



“Thank you to the Astro Pi, because it has given a very great opportunity to young people to increase their STEM ability.”

Survey response

Most mentors agreed that young people gained some skills, regardless of whether the team achieved flight status. 83% of mentors reported an **increase in their teams’ ability to think logically**.

Continued participation

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**.

Mentors described how the young people gained confidence in their ability to engage with technologies. One mentor described the “self-esteem” and “pride” younger pupils gained from knowing they were part of an international project. Others talked about the confidence that came with achieving something like having their code run in space. This confidence led them to want to continue to engage: mentors described examples of young people using these skills in robotics challenges or other projects from the ESA.

Impact on the community

Mentors described increased engagement with parents and the wider community as Mission Space Lab created a “buzz” that drew attention to the work of the young people.

“The community was very excited about the presence of [the young people’s code] on the ISS. It’s a great opportunity to show people that young students can do things.”

Focus group attendee

Understanding how technology is changing the world and can be used to solve problems

When we spoke to mentors about the experiences of young people, they talked about how much young people valued the **connection between Mission Space Lab and real-world problems by engaging with real technology on the ISS.**

“Participating in Mission Space Lab offers students a great opportunity to work with the International Space Station, to see the Earth from above, to challenge them to overcome the terrestrial limits. It’s very important.”

Focus group attendee

Impact: Mission Zero

Skills in computing and digital making

Mission Zero is many young people's first experience using Python. While we know this is a big challenge for some young people, mentors told us they valued the opportunity to introduce Python to young people.

"I think it was very good at setting up the first bit of Python and just having a very limited command set and a very quick result..."

Focus group attendee

Continued participation

72% of mentors told us they thought it was likely or very likely that **young people would participate in other ESA projects** and 56% said they thought young people would continue on to Mission Space Lab.

Running Mission Zero also generated interest from the community. 78% of mentors said their team's/teams' participation in the Astro Pi Challenge somewhat or very much **led to other mentors or young people becoming interested in taking part in the future.**

Young people are... "going around with the certificates and saying that they were space scientists and that's very interesting because then that creates a kind of a movement..." and other young people ask "...if they could participate."

Focus group attendee

Mentors told us that they valued Mission Zero because:

- It provides a connection with **real-world technology and problem solving**
- It allows **exciting conversations and continued learning about space**
- In schools, it **works well with other learning** such as art
- **Young people are so proud of becoming "space scientists"** and showing off what they achieved with their certificates

“We want students to use their digital skills as superpowers to make the world a better place and this competition really aligns with that because, regardless of your race, your ethnicity, your gender, you can write some code that actually runs in space. And if you can do that, then you can make medical tech, you can solve the big problems that the adults of the world are still grappling with. So it’s the opening up of opportunities.”

Focus group attendee

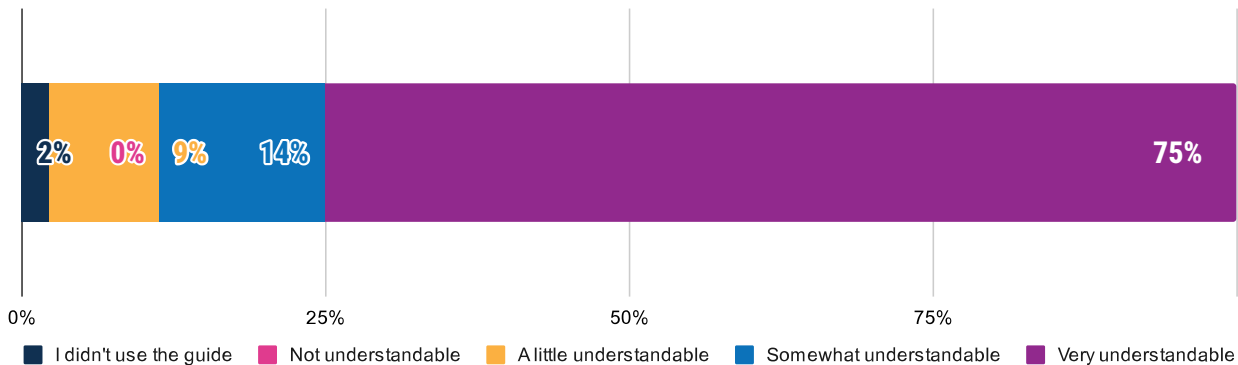
Mentors’ experiences: Mission Space Lab

95% of mentors said they somewhat or very much **enjoyed taking part in Mission Space Lab**.

Resources

Mentors valued the guidance supplied for the Mission Space Lab project. 89% said that it was somewhat or very understandable.

How understandable and clear were the Mission Space Lab Project guides (for example, the creator’s guide)? (N=44)



“The Mission [Space] Lab guide was fantastic for my students, step by step.”

Focus group attendee

Mentors' experiences: Mission Zero

99% of mentors said they somewhat or very much enjoyed taking part in Mission Zero.

84% of mentors rated Mission Zero as a 9 or 10 out of 10 when asked if they would recommend Mission Zero to a friend or colleague.

Resources

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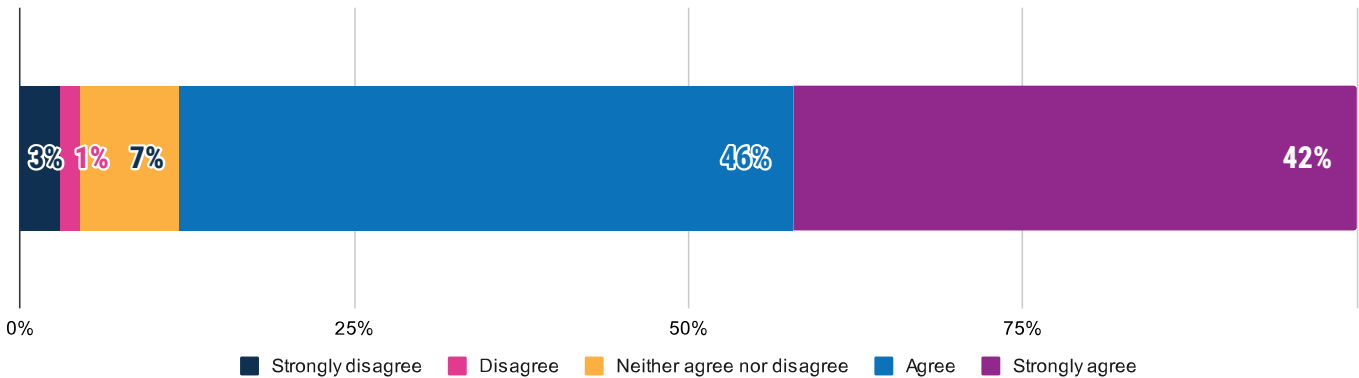
"It was a straightforward process from the registration to participate, to testing the code."

Focus group attendee

Mentors' skills and experience

88% of mentors felt confident they had the **skills and knowledge to support their team.**

I had the skills and knowledge to support my team(s) with Mission Zero (N=135)



Next steps

We are continuing to reflect on how we can build on the success of the Astro Pi challenges, and how we can make the experience better for young people and mentors. We have already started to make changes to Astro Pi 2024/25 in order to improve the experience:

Mission Space Lab

We've created an online testing tool for Mission Space Lab, called Astro Pi Replay. This tool displays basic error reporting and displays program output files so that it will be easier for teams to test whether or not their code works. It will also feature new data and images captured from the ISS in spring 2024.

Mission Zero

We've added a save button to Mission Zero to allow young people to work on this across multiple sessions. We're adding new code examples to the Mission Zero project guide. These have been selected from team submissions from the 2023/24 challenge. We have produced and translated a mentor guide for Mission Zero this year, and created a new classroom handout for young people to design their art offline.

Conclusions

The evaluation suggests that Mission Space Lab and Mission Zero have a positive impact on young people. Mentors told us that Mission Space Lab increases skills and confidence in computing and digital making, STEM, and logical thinking.

Mission Zero supports young people with their first steps in text-based programming. It is also a valuable tool to encourage wider conversations and learning about space, science, and art. Young people gain a real sense of pride and achievement by taking part and knowing their code ran in space.

Young people feel inspired to continue to learn as a result of Astro Pi. The fact that the projects run on real technology on the ISS is motivating for young people and gives them confidence to engage with new and emerging technologies.

The evaluation also suggests that Astro Pi has a positive impact on young people not involved in the project, with young people wanting to get involved and join in, as well as increasing engagement with parents and the wider community.

