Concept Space Clubs

Space Exchange Switzerland for the Swiss Space Office
Hanna Sathiapal, Institute for Data Science FHNW
2022, updated May 2025

Content

The Space Clubs in a nutshell

Space Clubs aim at fostering long-term engagement in space and astronomy by offering
- participation in citizen science and other projects
- an inspiring learning environment and field trips
- exchange of ideas and thoughts with peers and experts

The prototype SCs were tested and implemented at Raumschiff – the Maker-Space for Astronomy starting in September 2022. It consists of three age-based sub-clubs who meet separately but join for specific activities such as the space festival at the end of a season:
- The Planet Club (grades 2-4)
- The Galaxy Club (grades 5-8)
- The Cosmos Club (youth and adults)

A season at a SC takes place during the darker months from October to April. This allows for occasional spontaneous observation of the sky. Workshops, meetings and activities are held on a bi-weekly basis, except during holidays. Participants register for the entire season for a relatively low fee of between CHF100 and CHF200 to cover material costs. They can participate for just one or for as many seasons as they wish. Some activities, such as excursions, space parties and observation nights, are open to the public: participants' families and diverse audiences. Some of these events may be occasions for press coverage. Each season ends with a space festival where all clubs share their projects with the public and more space-related attractions are organized.

Participants are recruited through articles in the local newspaper, posters and flyers in public spaces, announcements in Raumschiff's- and SXS' mailing lists, event calendars of dedicated institutions (e.g. SATW), social media, ads in astronomy (Orion) and family journals. The public events also serves to arouse the interest of potential new participants. For those, and for inquiries throughout the year, a list is set up.

During the prototype phase (and beyond), the Planet and the Galaxy Club (for children) was led by an experienced person with a background in science communication and informal learning, who is also responsible for the concept of the Space Clubs (Hanna Sathiapal). The Cosmos Club (for youth and adults) is lead by an experienced lay astronomer (Lukas Schmid), who has a broad technical background and experiences in observation and astrophotography. For events, helpers are recruited from all clubs. By involving some actively, leadership skills can be fostered and diversity promoted. Expert scientists and engineers are invited for Q&A and workshops. Close cooperation both with academic institutions and lay communities have been established.

The Planet Club (grades 2-4)

Younger space enthusiasts learn basic skills and concepts around the solar system and its exploration. They receive more guidance than their older peers at the Galaxy Club. In the first part, participants explore a topic in-depth and learn the skills to, step by step, start working on their own projects in the second part of the season.

Skills include:

- Asking, pursuing and discussing questions related to space
- Basic computer skills (navigation, image search, downloading, saving and storing, software: WorldWideTelescope)
- Basic electronic skills (LEDs and small motors)
- Basic photography and video skills
- Basic crafting and tinkering skills using everyday materials
- Model making

Activities include

- Creating models (planets, systems, spacecraft)
- Inventing planetary rovers
- Processing raw images from space telescopes

Participating children keep record and draw their inventions in a book with black pages.

They will meet with older and more experiences peers (role models) and expert scientists and engineers.

Weather allowing, a telescope is installed on the roof of the building to observe the moon, planets and their moons.

Each season, an excursion to an observatory, a lab or a planetarium is organized.

The Galaxy Club (grades 5-8)

The club for children and teenagers up to 15 years takes the activities of the Planet Club a step further towards more self guided exploration and project work.

New contents, methodologies and tools will be in introduced
- Citizen science projects
- Data archives and resources, e.g. NASA's Eyes or ESASky
- Image processing and visualization tools
- Collaborative online platforms
- Tinkering materials and techniques

During some sessions, participants will work on their own creative projects around science, technology and art. These may include:
- Processing raw images from space telescopes
- Making stop motion space movies
- Creating models of deep space objects
- Designing space art and personal exhibitions
- Making a telescope and learning to observe the night sky
- Programming a solar flare alert lamp (IoT)

Participants will be systematically supported in their own endeavours.
- Training sessions for citizen science projects. Topics can be adapted to space actualities such as the launch of a new mission.
- An inspiring learning environment to trigger ideas: example projects, images, models, links/QR-codes, books, articles
- Access to experts: invitations, online meetings, email correspondence
- Collaboration opportunities and exchange among the participants: sharing and discussion sessions, online collaboration, social events

Like the participants in the Planet Club, those in the Galaxy Club will have their own research book.
Weather allowing, a telescope is installed on the roof of the building to observe the moon, planets and their moons.
Each season, an excursion to an observatory, a lab or a planetarium is organized.

The Cosmos Club (youth and adults)

This Club is dedicated to everyone over 16. It is a meeting point for individuals interested in astronomy and space ranging from newcomers to experienced lay astronomers. A series of lectures with experts in cutting edge topics is organized. Each fall, an excursion to observatory, lab or exhibition is organized.
Lukas Schmid, an astronomy educator at FHNW is in charge of this club and works out the details of its program.

One of the main 'raison d'être' of the club is that the participants will be able to share their passion both with the like-minded and with experts. Before and after each lecture, the bar at Raumschiff invites participants to continue discussing the topics with the expert and interested peers. Over time, friendships start to grow around the topic of space.

We are aware that young people between 15 and 25 years are among the hardest to reach groups in science communication. On the long term, we expect to be able to continue working with young adults who already participated in the Galaxy Club.

Background

The concept for the Open Space Clubs is based on

1. Research in STEAM learning outside school
2. The challenge of engaging people long-term

Background 1

Research in STEAM* learning outside school

The concept of the Space Clubs is based on the findings of the H2020 research project SySTEM2020 - Reshaping Science Learning Outside the Classroom which, between 2018 – 2021, studied STEAM learning experiences of almost 3000 young people between 8 and 21 years in 17 European countries. FHNW was one of the partners. Research was carried out at Raumschiff – the Maker Space for Astronomy, where the prototype Space Club was developed, tested and implemented.

The results don't come as a surprise. They show that a positive attitude to STEAM is influenced by several factors: school performance, high self-motivation, perceived relevance of STEAM at the learner's home and peers who also enjoy STEAM learning. The survey confirmed the findings of previous studies: the biggest influence on attitudes to science and technology and subsequent career choices is the educational background of the parents[1].

The results call for a systemic approach to STEAM learning outside school. Conceptual thinking needs to consider the complex learning ecology involved in STEAM learning at a particular place: families, neighbourhood situations, other informal learning opportunities (museums, science centres), community resources (libraries, cultural associations), relationship with schools, academic institutions and astronomy associations. Based on this, program planning is not only oriented at supporting individual learners but also at contributing to strengthening and expanding the local learning ecology.

As attitudes to STEAM are shaped in early childhood, preferences emerging at this age may influence career decisions due much later. Therefore, the Open Science Clubs will put effort into arousing interest at early age and nurturing it throughout life.

Research has also shown that girls enjoy STEAM programmes that combine science, technology and the arts. At Raumschiff, we observed that the style in which we announce and carry out programmes or events influences the kind of audiences we reach in the immediate neighbourhood, where people see the shop windows. Here, we have been able to increase the number of girls and women to 50% or more. However, when parents actively search for activities for their children, the number of girls who participate in the clubs drops significantly.

In any case, a single Space Club doesn't make much of a difference. The plan for the future is to build up a network of SCs jointly working on enriching engagement opportunities in space to contribute to a high-quality STEAM learning landscape in all parts of Switzerland. It will not only serve children and adults who are already excited about space but also more and more of those who have not yet been reached.

*STEAM refers to Science, Technology, Engineering, the Arts and Mathematics

Background 2

The challenge of engaging people long-term

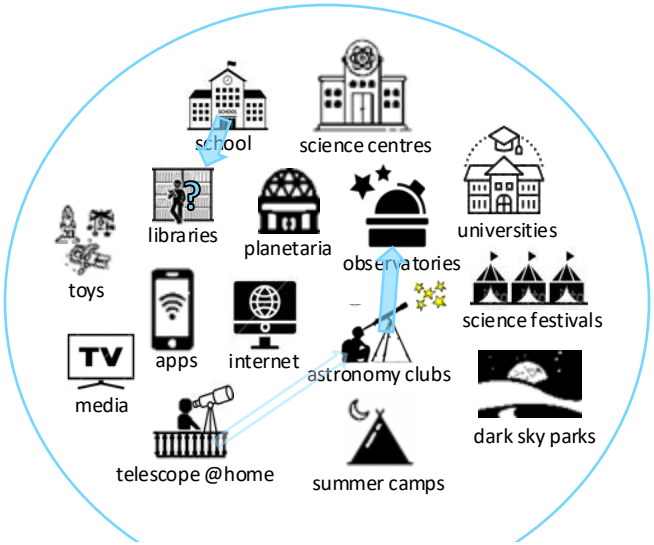
At Raumschiff – the Maker-Space for Astronomy, we have experimented with new engagement formats since 2016. Long-term engagement was one of the goals we pursued from the beginning. However, simply offering regular opening hours like a science center didn't lead to the kind of engagement we had hoped for. Next, we developed an astronomy class comprising 14 units (Der geheime Schlüssel zum Universum) along the book 'The Secret Key to the Universe' by Lucy and Stephen Hawking) which was very successful but took an enormous amount of effort preparing the modules. And once the class was over, there was no program to follow up with.

We started to high-quality how long-term engagement worked in other fields. In the case of music, there is a rich learning environment comprising a multitude of institutions from pre-school music classes to opera houses, tools from all kinds of musical instruments to supporting technologies, musical styles for every taste, cultural practices both with a long tradition and very recent ones, a well-established canon of educational literature and methodologies, highly professional teachers and research in music education. Music is everywhere including for those who don't choose to practice it actively. Should someone decide to learn music, most people would know about several ways of getting started. Of course, the fact that music is taught at school helps. However, this didn't come automatically but is the result of decades of intense lobbying and persuasive efforts. Still, the bulk of high-quality music education takes place outside school, although there may be regional differences.

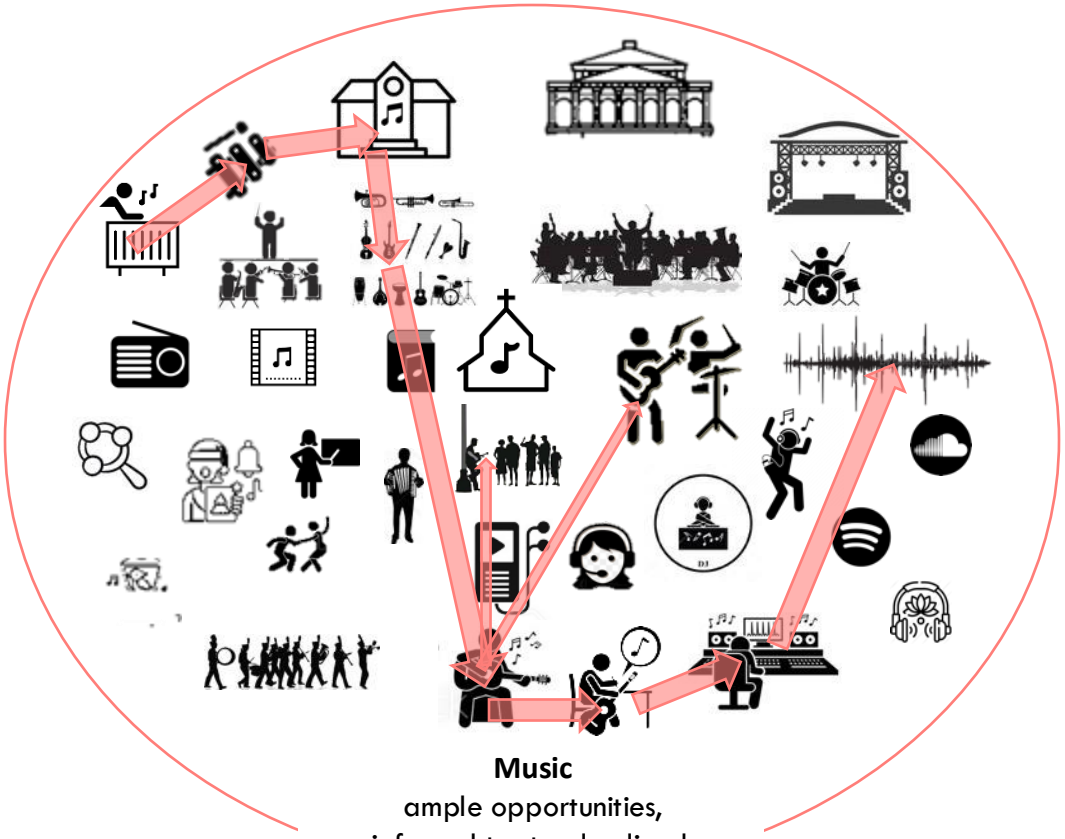
In the space sector, the situation is different. To this day, in Switzerland, there are no possibilities to pursue a well supported pathway to astronomy like to music or sport. Joining an astronomy club is not something many people would consider doing. Some try to delve into their area of interest on their own, doing their explorations on YouTube and other media channels. They may gather an enormous amount of knowledge autodidactically, sometimes at a young age. These people will benefit from guidance helping them to distinguish between trustworthy and dubious sources of information and from support in using their knowledge actively. To return to the example of music, there is a difference between knowing a lot about music and playing an instrument. The same applies to space and astronomy.

Here, the Space Club comes in. It is a place where those who are already enthusiastic about space receive support in their endeavours and inspirations for new ones. Educators, scientists and engineers at the SC will support participants in their individual pathways, fostering engagement over a few months up to several years. They will process existing and new resources into high quality activities, create the joints that link them together and provide a framework for meaningful exchange with the like minded.

At the same time, due to its physical location (shop window) and public events, the SC brings visibility beyond the existing communities, reaching out to those who don't think of space as 'their thing'.



Space/Astronomy
occasional opportunities,
poorly connected,
difficult to find one's way



Music
ample opportunities,
informal to standardized,
well-connected,
many possibilities,
short-term to livelong,
for diverse tastes and abilities

Illustration: Comparing pathways to long-term engagement in space/astronomy to that in music. Although not as encompassing as in music, there are resources related to space and astronomy. However, pathways need to be created to allow for long-term engagement.

Strategies

Efforts to build up long-term engagement in space/astronomy to successfully run the Space Clubs will take place at five levels:

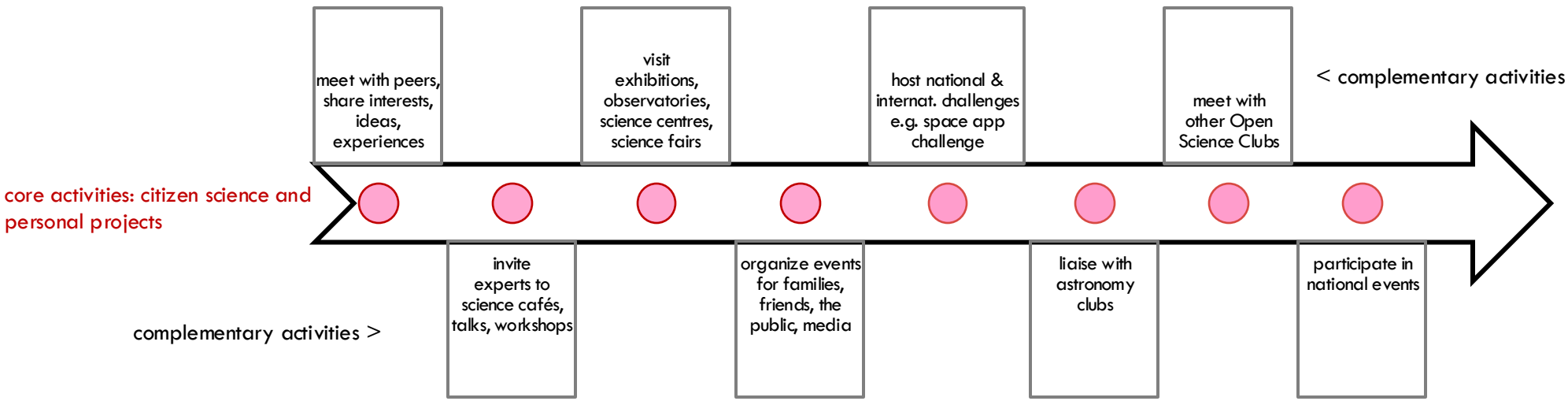
1. Developing a methodology for long-term engagement
2. Facilitating access to open resources (including citizen science)
3. Widening participation
4. Strengthening the space learning ecosystem
5. Designing for inclusion and resilience

Strategy 1

Developing a methodology for long-term engagement

At Raumschiff we learned that simply offering a series of workshops doesn't necessarily lead to long-term engagement, no matter how excited participants are about a topic. They didn't learn how to continue after the course was over. They were neither prepared for self-guided activities nor aware of any follow-up programmes taking place elsewhere.

The program tested during the prototype phase 2022/23 took into account these experiences. It included a mix of workshops around citizen science projects (these activities can be pursued over a long time and expanded according to participants interests), support for self guided activities and complementary activities, all adapted to the age and the previous knowledge of the participants. Participants subscribed for a full season. Those interested could continue for up to several years, enjoying new inputs, support and a community of peers with the same passion while increasingly engaging in more complex and challenging activities.



Strategy 2

Facilitating access to open resources

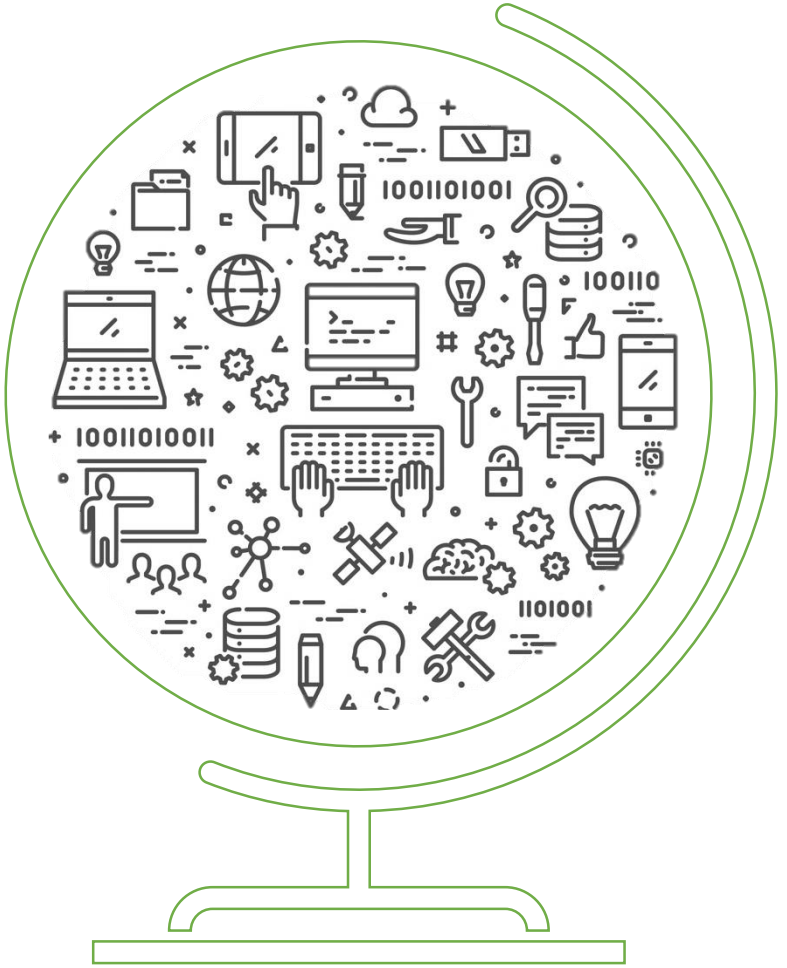
The Space Clubs supports participants in citizen science from beginning to advanced levels. However, scrutinizing and categorizing images from space may be boring if there is a lack of understanding about the topic and the data the volunteers handle.

At the SC, participants receive

- introductory workshops to selected projects
- support for deeper exploration of their topics of interest
- opportunities to meet experts and peers

In addition, the OSC facilitates access to open resources such as satellite image archives, image processing software and other tools for personal projects at all levels, from young children to adults. Although some of the existing open resources have great user interfaces and fascinating content, most people don't know about them nor how to make use of them.

By promoting the use of open sources the SC pursues an approach to space education that best corresponds to contemporary scientific practices.



Strategy 3

Widening participation

Activities and events like field trips, science cafés, talks, the observation of a particular phenomenon in the sky, star parties and the space festival at the end of a season are open to everyone. This allows the clubs to extend the reach to new potential participants, those who don't want to get involved on a regular basis (yet) and even people who wouldn't think of space as something they might be interested in.

An important group we aim to address at these events are the families and friends of the Space Club participants. Parents will be involved from time to time and learn how they can support their children at home, as it is well known that career decisions are made within the family.

Advertisement measures for these events results in increased visibility of the project as a whole and awareness about opportunities among people who might not be able to participate at a particular event. The local press may be invited to some of the events, resulting in press coverage.

The location of the Space Club and the attractivity of the display in the shop window is a strategic tool in raising awareness about the field of space in general, selected topics in particular and opportunities to participate. Raumschiff is located in a neighbourhood with a high percentage of families with migrant backgrounds. This helps to address this sometimes hard to reach group and build trust.

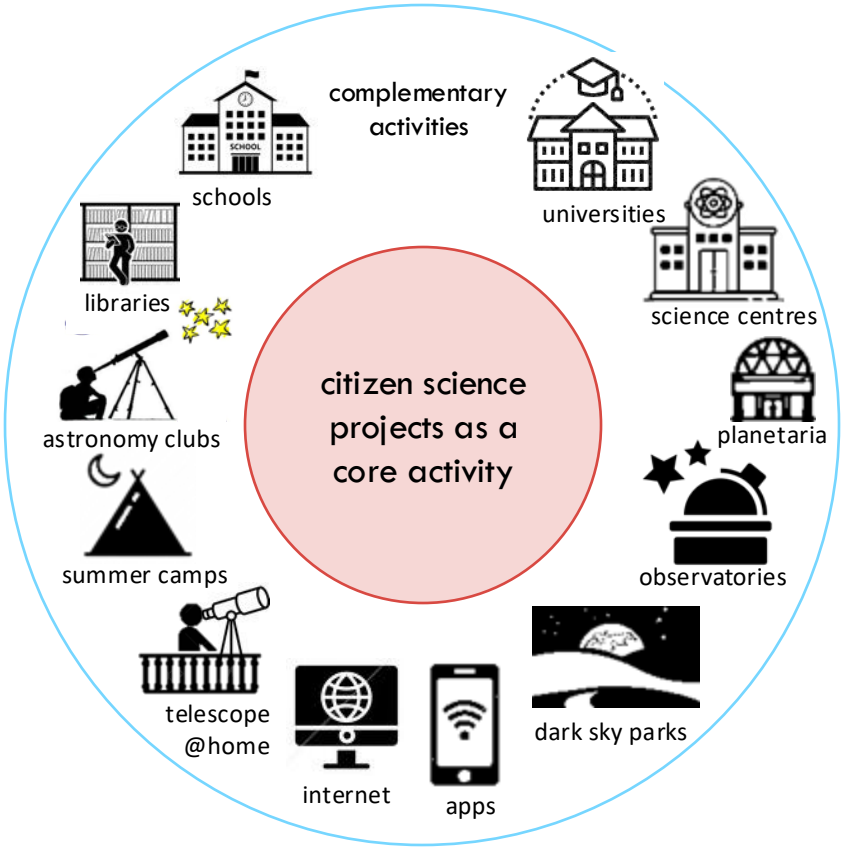
Strategy 4

Strengthening the space learning ecosystem

The Open Space Club interlinks the learning landscape creating pathways to space and astronomy. Participants will have the opportunity to

- get introduced to existing **citizen science** projects and **open data resources**
- share interests with **peers** in a social environment
- learn what other **astronomy-aficionados** do
- meet with **experts**
- visit **places of interest, including observatories and exhibitions**
- co-organize **public events**
- participate in national & international **initiatives and competitions**
- learn about more **opportunities** to engage

In these pathways a variety of people and institutions will be involved, cooperation opportunities discovered and, finally, a network of actors in the same field but with different approaches established.



Strategy 5

Designing for inclusion and resilience

Diversity is still low in the Swiss space sector. Some strategies to reach a more diverse audience and, finally, generate a more diverse workforce are already its awareness raising, role models, meeting diverse people who work in the field, the use of language, avoiding stereotypical representations of people working in the space sector, styles and colour schemes related to space topics, combining science, technology with arts, models to reconcile family and work etc. Not technologies, these strategies have been fully implemented, yet, and the results form the efforts taken are far from satisfactory. More efforts are needed.

An Space Club has the opportunity to fine-tune efforts towards inclusion by observing in detail what works and what doesn't, testing new approaches and adapting the concept accordingly. At Raumschiff, we managed to reach female participation of over 50% in the first years, both in activities for children and events for adults. However, with increased interest and success, the number of female participants dropped – an unexpected challenge. The backgrounds of the visitors are much broader than those of visitors at events we had organized at FHNW before, while, in many cases, interest, enthusiasm and previous knowledge is similarly high. However, we are aware that we cannot take this for granted in the future, in particular in the context of long-term engagement. Attention to diversity needs to continue at a high level.

We also observed that, during the pandemic, children without a strong educational and technological support at home would have dropped out if we had simply moved our programmes online. Like most institutions we went through a period of closure. After some experimenting with remote technologies, we found a creative solution that also worked for unsupported children.

Considering the experiences during the last years, we are now better prepared to anticipate challenges and prepare solutions in advance. At the SC we will introduce opportunities for activities at home throughout the season.

Although there are useful guidelines for inclusive practices, what works and what doesn't also depends on experiences. This is where a single Space Club reaches its limits. It takes a larger community of practitioners to exchange experiences and co-create working solutions to reach better results in the field of diversity and inclusion. This will be one of the roles of the future network of Space Clubs.

Evaluation

Evaluation takes place both during the project (concurrent) to adapt practices and after the project (summative). During the prototype phase, a relatively small number of people were involved in the clubs, thus, most evaluation was qualitative.

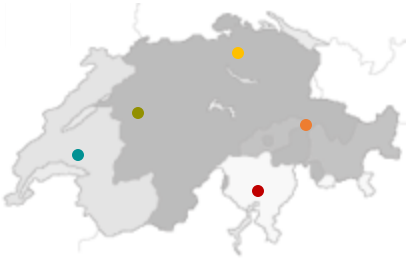
During the season

- Notes after each session
- Documentation of participant projects (photo and/or video)
- The final event (space fair) is a way of evaluating what resonated with participants and what they learned

After the season

- Number of regular participants in the clubs
- Number of participants at the public events
- Numbers related to inclusion and resilience (gender, family background (in science/technology or not), drop ins /drop-outs, participation rate on site / at home, if applicable)
- List of open resources used
- Description of the network created and map of the learning ecology system at work during the project
- Assessment of what worked, what didn't and where new solutions are needed

Beyond the SC prototype

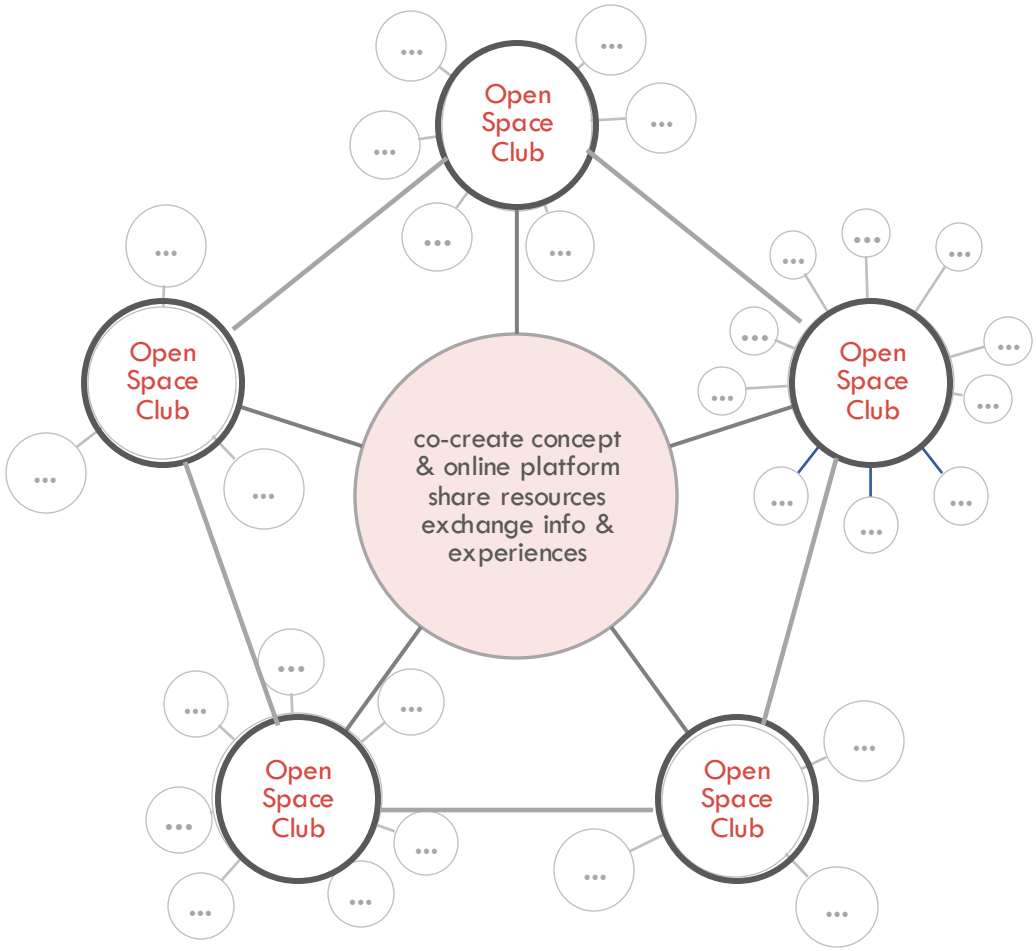


The Open Space Clubs network

A single Space Club will not be able to sustainably improve the space learning ecology in Switzerland. Not only for its small reach in terms of numbers of participants and geographical scope, but also for its limited leverage effect working in isolation.

The long-term objective is therefore to establish several different clubs covering all language regions in Switzerland. Each club will run a program adapted to its particular context. All clubs will work together to share resources, tackle challenges and co-create solutions. Beyond sharing educational resources and experiences, examples of topics that benefit from joint efforts include:

- raising female participation,
- improving inclusive practices,
- catering for the gifted,
- tackling hard to reach audiences,
- designing for resilience in difficult situations such as a pandemic.



Expected long-term impact

The approach to be tested with the Space Club prototype in 2022/2023 aimed at introducing a new way of promoting space and astronomy outside the formal school system for the benefit of society. Establishing such clubs swiss-wide is a long-term effort. Continuity and planning stability is key. Accordingly, the impact must be considered in the long-term and in respect to the broad public.

The expected impact includes:

- Raised awareness about space, current research in this field, the role of Switzerland and the importance of international cooperation
- Increased understanding of the societal relevance of research and development in the field of space and astronomy
- Less notions of space as an elitist activity for a privileged few
- Improved science literacy for better informed decision making
- Sound basis for career decisions
- Increased equality of opportunities