

Accessibilising Astronomy: SciAccess Programmes for Disability Inclusion in STEM

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SciAccess, Inc. is an international non-profit organisation dedicated to advancing disability inclusion and diversity in STEM education, outreach, and research. In this paper, the authors present an overview of accessible STEM programmes run by SciAccess, including an annual conference, an international working group, Zenith (a space science mentorship programme for blind youth), and Mission: AstroAccess (an initiative dedicated to making space exploration accessible for disabled astronauts). Recommendations for creating accessible mentorship programmes and networking events, both virtually and in-person, are detailed so that others may replicate these inclusion-focused efforts.

Introduction

In 2018, SciAccess was founded by The Ohio State University ("OSU") graduate Anna Voelker in response to an overwhelming need to address a lack of accessibility, diversity, and visibility for scientists with disabilities in STEM. It was made possible by the OSU President's Prize – a \$100,000 startup grant for projects that foster social change. SciAccess began as a one-time conference dedicated to promoting

disability inclusion in science, technology, engineering, and mathematics (STEM). From there, SciAccess grew into an international initiative that has since branched off into myriad programmes working towards a more equitable future.

While it is estimated that 26% of Americans have disabilities (NCBDDD, 2020), people with disabilities represent only 8.3% of all workers, with an estimated 1.6% employed in science and engineering

in the United States (NCSES, 2019). Advancement in these fields is highly influenced by networking opportunities such as conferences, internships, career fairs, virtual seminars, and social events (Mickey, 2019). When these opportunities are inaccessible, disabled students and professionals are denied the same experiences as their non-disabled colleagues, harming their employment prospects.



Figure 1. Group photo from the SciAccess 2019 Conference. Credit: Heather Taylor



Figure 2. A map of the 54 countries represented at the SciAccess 2020 and 2021 conferences combined. Credit: Anna Voelker

People with disabilities comprise the world's largest minority group (*DoL ODEP, n.d.*), yet they are severely underrepresented in the STEM fields. In response to these discrepancies in employment and education rates, SciAccess seeks to foster equitable STEM opportunities by providing spaces where disabled scientists, educators, students, and advocates can share their experiences with one another and with their non-disabled peers. SciAccess aims to advance the development and dissemination of best practices in accessible STEM research and education through a growing series of international programmes (Figure 1).

Overview

An overview of projects led by SciAccess, Inc. is presented below.

SciAccess 2019 Conference

On June 28 and 29, 2019, SciAccess: The Science Accessibility Conference was held at OSU. This inaugural event brought together 250 scientists, educators, students, and disability rights advocates to share best practices for STEM accessibility. The SciAccess 2019 Conference featured

over 60 speakers, including keynote presentations from Dr Temple Grandin, professor of animal science and renowned autism advocate, and Anousheh Ansari, the first female private space explorer.

SciAccess 2020 Conference

On June 29, 2020, OSU hosted SciAccess 2020: The Virtual Science Accessibility Conference. With the worldwide transition to online learning and remote work during the Covid-19 pandemic, this event took place virtually and brought together speakers and attendees from around the world who share a dedication to inclusive science. The SciAccess 2020 Conference had over one thousand total registrants and 555 participants on the day of the event, with attendees joining from 46 nations and all seven continents, reaching as far as the South Pole. The conference culminated with a keynote presentation by Dr Soyeon Yi, who shared her experiences as the first and only South Korean astronaut.

SciAccess 2021 Conference. The SciAccess 2021 conference took place virtually on November 12 and 13, 2021. This event was hosted in partnership with Geneva Lake Astrophysics and STEAM (GLAS) Education, a leading non-profit

in accessible education and winner of the National Federation of the Blind 2020 Bolotin Award. The SciAccess 2021 Conference brought the total number of unique countries reached by SciAccess conferences to 54 – SciAccess has participants in nearly 30% of the world's countries. SciAccess 2021 was supported by the Battelle Engineering, Technology and Human Affairs (BETHA) grant from OSU. The conference featured over 50 speakers, including keynote presentations by Dr Chris Boshuizen, Blue Origin Astronaut and Co-Founder of Planet Labs, Sirisha Bandla, Astronaut and Vice President of Government Affairs and Research Operations at Virgin Galactic, Apurva Varia, NASA Mission Director and Mission: AstroAccess Ambassador, and Dr Joshua Miele, 2021 MacArthur Fellow and Adaptive Technology Designer (Figure 2).

SciAccess Working Group

The SciAccess Working Group serves as a platform for like-minded individuals to join the SciAccess community. It is a collective of professionals that meets virtually every month to discuss the latest developments in accessible STEM. Individuals interested in joining can do so by filling out the form at go.osu.edu/wg.

SciAccess Zenith Mentorship Programme

The SciAccess Zenith Mentorship Programme ("Zenith") is a virtual mentorship programme for blind and low vision (BLV) students interested in astronomy. Established in August 2020 in partnership with OSU and the Ohio State School for the Blind, Zenith connects 8-12th grade BLV students with undergraduate and graduate student mentors at OSU. Zenith uses multi-sensory resources such as 3D-printed models of astronomical objects, provided by the nonprofit See3D, and data sonification, provided by the citizen science project Transient Zoo, to provide an accessible entry point into astronomy. For example, students learn to study supernovae light curves through sound and tactile graphs while working closely with their mentors and fellow students.



Figure 3. Centra “Ce-Ce” Mazyck, AstroAccess Ambassador and Disabled American Veterans representative, floats in microgravity aboard the inaugural AstroAccess Zero-G mission. Credit: Zero-G / Al Powers

Mission: AstroAccess

Mission: AstroAccess (MAA) was founded in 2021 to help build the future of accessible space exploration. This program is run in partnership with Yuri’s Night/The SpaceKind Foundation and was co-founded by Anna Voelker, Executive Director of SciAccess, Inc., and George T. Whitesides, former CEO of Virgin Galactic and former NASA Chief of Staff. Through MAA, disabled scientists, engineers, veterans, students, athletes, and artists, known as “AstroAccess Ambassadors”, participate in parabolic flights in partnership with the Zero Gravity Corporation (“Zero-G”). During these flights, the Ambassadors perform experiments and demonstrations in weightlessness in order to investigate accessible tools and technologies for future space vehicles and space stations. MAA aims to prove the feasibility, importance, and value of ensuring that all individuals, regardless of disability on Earth, can live, work, and thrive in space. The first MAA parabolic flight mission flew on October 17, 2021, out of Long Beach, California with twelve AstroAccess Ambassadors onboard (Figure 3). In May 2022, AstroAccess Ambassadors flew with the MIT Space Exploration Initiative and the Aurelia Institute on two additional Zero-G flights. The next AstroAccess mission will take place on November 19, 2022, in Fort Lauderdale, Florida, in order to advance research on accessibilizing human space exploration. For more information, visit [AstroAccess.org](https://astroaccess.org).

Practise Recommendations

Best Practices Recommendations for an Accessible In-Person Conference

For SciAccess 2019, the organisers employed various methods to ensure the conference’s accessibility. Based on this experience and the corresponding attendee feedback, the following is recommended for in-person events:

Quiet room

A quiet room, or sensory-friendly room, provides attendees with a designated space for taking a noise-free break from socialising and conference commotion. The SciAccess 2019 quiet room included service dogs and art supplies. The benefits of sensory-friendly rooms have also recently been seen at select commuter airports (Davis, 2019).

Colour communication badges

Introduced by Autism Network International, colour communication badges allow conference attendees to share their communication preferences nonverbally (ASAN, 2014). Red, yellow, and green slips of paper are inserted into the attendees’ name tags, who choose which colour they wish to display at any given time. This system allows attendees to clearly communicate their preferences on a gradient scale and eases all participants’ networking anxiety. Large print and braille labels can be included

on the colour badges for attendees who are blind, low vision, or colour blind.

Pronouns on name tags as the default

Displaying pronouns (e.g., he/him, they/ them) on attendee name tags normalises the practice of sharing pronouns. On the SciAccess 2019 registration page, attendees were asked to specify their pronouns and were informed that this selection would be displayed on their name tag. By making pronoun sharing the default, nearly all conference attendees chose to display their pronouns on their name tags, creating a more inclusive environment. Due to the precedent set by SciAccess 2019, IAU 358 Symposium in Tokyo in November 2019 adopted this practice.

Braille and large print materials

During the registration process, attendees were asked for their accommodation requests. Specifically, braille and large print event programmes were available upon request to BLV participants.

Tactile map

The SciAccess 2019 Conference provided BLV attendees with access to a tactile map of the conference venue made using thermoform, a plastic-like paper used for tactile graphics.

Guide Volunteers

Conference volunteers were on-call at all times at the central information desk. If a BLV attendee requested assistance locating a specific room, volunteers were trained to help guide the attendee to their destination.

Sign Language Interpreting

Sign language interpreting is essential for the inclusion of Deaf attendees. If a conference has concurrent sessions, organisers should provide sign language interpreters for each Deaf attendee so that they can go to the session of their choice instead of being restricted to a single conference strand. If an event does not have the budget to facilitate this, the organisers should consider transitioning to a single-strand conference with no concurrent sessions.

CART captioning

Communication Access Real-time Translation (CART) uses a human captioner to provide a word-for-word

transcription of an event. Captioning not only benefits Deaf and hard-of-hearing attendees but also supports accessibility for second language learners (Gernsbacher, 2015). We suggest using human-transcribed CART captions rather than auto-generated captioning services for the best quality.

Accessible seating

In each conference room, multiple comfortable armchairs were available for individuals with chronic pain and for anyone unable to sit in a rigid chair for long periods of time. These chairs were labelled with signs requesting that attendees reserve this seating for those who need it. When implementing seating changes, it is important to ensure that armchair placement does not impede wheelchair access. For social events, it is best to avoid high-top cocktail tables. These are inaccessible for people using wheelchairs and anyone who cannot stand for long periods of time.

Slide descriptions

Train all speakers to describe their presentation slides, including verbally describing all visual content so that BLV audience members are included.

Star party accessibility

When hosting stargazing events, locate telescopes in a wheelchair-accessible area. If your observatory is not accessible, set up portable telescopes outside on the ground level, preferably along a paved area instead of in the centre of a grassy field. Table-top telescopes and binoculars can help provide more accessible stargazing options. In addition, events can use 3D models and tactile graphics of astronomical bodies to supplement the viewing experience with non-visual resources¹.

Fostering Accessibility During Online Events

As virtual events increase in popularity in the wake of Covid-19's onset, it is essential that accessibility remains at the forefront of program design. Based on the work of the virtual SciAccess 2020 and 2021 Conferences, the following is recommended for ensuring the accessibility of online programmes:

Slide descriptions

As previously mentioned, slide descriptions remain crucial for virtual programmes. In order to emphasise this during presenter trainings, tell speakers to imagine that screen-share is unavailable. What slide and image descriptions would be needed to convey information effectively without visual aids?

Pronouns

While most online events do not have name tags, organisers can still encourage attendees to share their pronouns by adding them to their Zoom profile or directly to their name on any video conferencing platform.

Increased breaks

Increase the frequency and duration of breaks in order to relieve "Zoom fatigue" (Bailenson, 2021).

Sign language interpreting and CART captioning

As with an in-person programme, these services are essential for the inclusion of Deaf and hard of hearing participants. Organisers using Zoom can follow these guidelines in order to successfully incorporate sign language and captioning within their virtual event: go.osu.edu/zoomaccess.

Developing an Accessible Mentorship Programme

Zenith aims to model and propagate best practices for accessible mentorship programmes. The first step in creating such a programme, or making a pre-existing programme accessible to a wider audience, is to build connections with the local community. Programmes should first and foremost be guided by the community's needs and feedback. Begin by contacting schools and organisations in your area that serve students and individuals with disabilities. Forming relationships with representatives from these institutions is the first step in identifying partners who can help design, advise, or adapt your mentorship programme to ensure it is a) accessible to underrepresented students and b) addressing the real needs of the community members it aims to serve. Organisations can also partner with local universities to recruit student mentors

and seek expert guidance from faculty advisors.

Zenith holds regular guest lectures with space scientists, including BLV astronomers, allowing the students to meet role models with similar life experiences. This representation plays a critical role in each student's ability to see themselves as future successful scientists.

Each semester, students select a topic they are passionate about in the field of physics, astronomy, or aerospace and work with their mentors to develop a professional presentation on their selected subject matter. The students then present their work to family, friends, and university professors at a research symposium – the programme's culminating event. Organisations interested in furthering this work by creating their own Zenith chapter can connect with SciAccess, Inc. to receive further guidance².

Conclusions

These accessibility initiatives serve an essential function in connecting people who have been historically excluded from the STEM fields. In addition to fostering an exchange of ideas, resources, and best practices, they serve as eye-opening experiences for younger generations of students with disabilities facing a severe lack of representation in STEM. When the talents and perspectives of people with disabilities are neglected, science suffers. By creating accessible programmes and events, organisations can prove to students and future scientists with disabilities that not only is there space for them in STEM but a profound need. Accessibility is an active, ongoing, and intentional commitment to creating inclusive engagement opportunities on earth and beyond it.

Notes

¹ Many 3D printed astronomy resources are available for free, including A Touch of the Universe: <https://astrokitt.uv.es/index.html>

² SciAccess, Inc. is made possible by dedicated volunteers with a passion for disability accessibility and inclusion in STEM. Individuals interested in volunteering with SciAccess, Inc. can do so at sciaccess.org/volunteer/. For more information, visit SciAccess.org.

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Biographies

Anna Voelker is the founder and Executive Director of the SciAccess, Inc., an international non-profit dedicated to advancing disability inclusion in STEM. Anna specialises in accessible science outreach and has previously worked at the Ohio State Department of Astronomy, NASA Kennedy, NASA Goddard, Space Telescope Science Institute, International Astronomical Union's Office of Astronomy for Development, and the Aerospace Corporation.

Caitlin O'Brien is the Deputy Director of SciAccess, Inc. She is an Astrophysics & Astronomy and Physics student at The Ohio State University. In 2019, she was named an Ohio State Morrill Scholar, recognising her as a student engaged in diversity, leadership, and service. She has worked with SciAccess since Spring 2020.

Michaela Deming graduated cum laude in May 2021 from The Ohio State University with a B.S. in Astronomy & Astrophysics. She began working with the SciAccess Initiative in Summer 2020 when she helped organise the SciAccess 2020 Conference. Since then, she helped found the SciAccess Zenith Mentorship Program, serving as its first president from October 2020 to May 2021.