

SESSION SUMMARIES
OF THE IAU OFFICES FAMILY MEETING,
20 – 22 JULY, 2021

AUGUST, 2021

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Publications of
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The following is a summary of the IAU Offices Family Meeting held 20 – 22 July, 2021 as a virtual event. The event was organised by the IAU Office of Astronomy for Education with assistance by the IAU Office of Astronomy for Development, the IAU Office for Astronomy Outreach, and the IAU Office for Young Astronomers.

The IAU Office of Astronomy for Education is hosted at Haus der Astronomie (HdA), managed by the Max Planck Institute for Astronomy. The OAE's mission is to support and coordinate astronomy education by astronomy researchers and educators, aimed at primary or secondary schools worldwide. HdA's hosting the OAE was made possible through the support of the German foundations the Klaus Tschira Foundation and the Carl Zeiss Foundation. The IAU Offices Family Meeting made use of the online conference platform acquired for the Shaw-IAU Workshops with the generous support of the Shaw Prize Foundation.

The 2021 IAU Offices Family Meeting: An Overview

I don't know who came up with calling this the "IAU Office Family Meeting". And the family label isn't perfect; volunteering is, by definition, a voluntary choice to do something, to join a specific community. But we are definitely a community, and it's undeniable that, both during this meeting and during our interactions elsewhere, there is a certain familiarity that goes beyond that within other communities. We share a fascination for astronomy. We definitely share the conviction that there is more to astronomy than science and research: Astronomy can help us reach out, can play a role in education both in a school setting and as we set about supporting young astronomers, and astronomy can help make the world a better place. The IAU put this in writing as it formulated its strategic goals 2020–2030¹: Promote the use of astronomy as a tool for development in every country. Engage the public in astronomy. Foster the dissemination of astronomical knowledge among professional astronomers. Stimulate the use of astronomy for teaching and education at school level.

Now, as we all know, having goals is one thing, implementing something else again. About a decade ago, the IAU was just beginning to set itself goals that went markedly beyond organising events and providing spaces for discussion for the community of professional astronomers. At that time, implementation was fully in the hands of that community: IAU members would organise in Divisions, Commissions and Working Groups, and the volunteer members of those self-organised bodies would collaborate to get things done. The first new step was in leveraging astronomy for development, as laid out in the Strategic Plan 2010–2020² and it was clear (and spelled out in the plan) that this would require new resources, and a new structure. Thus, the first of the IAU offices was born: the Office of Astronomy for Development (OAD), launched in 2011, hosted at the South African Astronomical Observatory in Cape Town, and with split funding: part of the financial support from the IAU, the other from the host partner, in that case the South African National Research Foundation as well as the country's Department of Science and Innovation. Within that new kind of structure, there were now staff members paid specifically for the work needed, which took IAU engagement to a whole new level. Other offices followed: the Office for Astronomy Outreach (OAO) hosted and co-funded by the National Astronomical Observatory of Japan (NAOJ), established 2012; most recently our Office of Astronomy for Education (OAE) hosted in Heidelberg at Haus der Astronomie and the Max Planck Institute for Astronomy, funded by the Max Planck Society, the Klaus Tschira Foundation and the Carl Zeiss Foundation with generous support by the Shaw Prize Foundation. The fourth office has a structure that is somewhat different — its defining activity, the International School for Young Astronomers (ISYA), has been going on since 1967; the Office for Young Astronomers (OYA) established in 2015 by the IAU and the Norwegian Academy of Science and Letters (NASL) is a virtual office, without dedicated staff of its own, a support structure for the ISYAs.

While the structure of Offices provided sorely needed resources, and the possibility to pursue

¹[https://www.iau.org/static/administration/about/strategic plan/strategicplan-2020- 2030.pdf](https://www.iau.org/static/administration/about/strategic%20plan/strategicplan-2020-2030.pdf)

²[https://iau.org/static/education/strategicplan 2010-2020.pdf](https://iau.org/static/education/strategicplan%2010-2020.pdf)

long-term goals much more effectively than before, the sheer scale of those goals — development, education, outreach, world-wide — required wider-ranging support. The International Year of Astronomy 2009 (IYA2009) had shown how such wider range could be achieved: With a network of 148 “National Nodes” coordinating and encouraging IYA2009 activities in the participating countries, each node with a person acting as Single Point of Contact (SPOC) to allow for (comparatively) easy coordination between the Nodes and the international organisers. Forty (mostly) supra-national organisations had their own “Organisational Nodes”, also with SPOCs. When the OAO was founded, it was in large part to keep going the international momentum the IYA2009 had generated. Many of those who’d been active during IYA2009 in their countries became the OAO NOCs (initially “National Outreach Contacts”, later “National Outreach Coordinator”) when the OAO initiated that volunteer program in 2013. The OAD went a different road (no pun intended) by establishing Regional Offices of Astronomy for Development (ROADs) and, with a focus not on a geographical region, but on areas with a common language, Language Offices of Astronomy for Development (LOADs). When the OAE started establishing its wider network, in early 2020, it went both routes: soliciting OAE Centers and OAE Nodes to support its mission internationally, and establishing National Astronomy Education Coordinator Teams (NAEC Teams) as liaisons to the separate countries’ astronomy education and wider education communities. (Incidentally, NOC is pronounced “nok” and NAEC is pronounced “naa-yek”.)

This, then, is where we stand today. And while the IAU Offices with their dedicated staff form a valuable core of activities, the volunteer community associated with the IAU is larger, more diverse and more important than ever. And while OAD, OAO and OAE each have their own communication procedures to keep in touch with their respective networks, it is clear that there is a considerable potential for synergy. We, here at the OAE, are particularly aware of this, given how instrumental contacts with the NOCs and ROADs were in helping us build our own NAEC network. Helping to forge ties and connections within this large community, with an eye towards how contacts between its various members could benefit our common (and even our separate) goals was the main idea behind this Office Family Meeting.

I do not want to withhold credit here, but I truly do not remember who came up, during our inter-office, Zoom-based brainstorming sessions, with the idea of making this meeting an Unconference (may be Kevin Govender, or at least someone from OAD?). The idea behind Unconferences is to allow meeting participants themselves to structure a meeting and its topics. In the end, we didn’t quite go the route of the dotastronomy conferences, with Unconference topics and participants being decided very short-term, interactively — we didn’t see how that could work for a large virtual meeting. Instead, we solicited topics, and asked participants to act as moderators. We did follow the principle that the results of those parallel meetings should be available to participants as a whole; thus the “Session summary” meetings after each block, and thus the write-ups you can find in this document here.

For some time, we weren’t sure if this would work well. It’s always a matter of expectations, of course. Both the proposals for session topics and the volunteer moderators seemed to trickle in slowly. With 249 registrations, it seemed to us that we were not reaching as many within our community as we could have. We later found out that we had inadvertently scheduled the meeting during the Islamic holiday of Eid al-Adha; our apologies to all whom we affected by that choice, and we will be more careful in the future. We had no clear indication whether the format, with the unstructured discussions, would work. Would there be completely empty sessions, for instance?

As soon as the sessions had started, though, things were looking up. Eagerly session-hopping, it seemed as if there were lively discussions everywhere. People were meeting each other, participants were making themselves heard and exchanging their views. Of course, a number of those speaking were familiar faces within the IAU network, but they did not appear to overly dominate the discourse — at least, in a poll during our closing session, 98% of respondents indicated that they had had sufficient opportunities to make their voices heard. A number of people did take the opportunity for random one-on-one meetings that the Hopin conference system allows for, although not as many as we had hoped: 50% did not use that system at all (40% did not even try); on the other hand, 36% of respondents used the system to meet up with 6 or more other participants.

So taking everything together, we do count the Offices Family Meeting as a success, if open to improvement in some of its aspects. Going back to the polls one last time: 82% of respondents agreed, insofar as they would like the event to be repeated. (16% were fine with either a repetition or none. 2% were opposed, which for a total of 49 participants in that particular poll corresponds to a single evidently unhappy respondent.)

Regarding the discussions during the various sessions, which you can find summarised in the following pages, all of them are part of wider and ongoing conversations. The Offices will follow up, and make sure that we carry those observations, wishes, critical comments and requests forward and, where possible, integrate them into our work. This is what the last sections of this document are about, which are written by the Offices themselves.

Numerous people have contributed to make the 2021 IAU Offices Family Meeting what it was. So thank you to all participants, to those who suggested topics, to those who moderated sessions, to all who participated in the meeting's discussions! Likewise to the leaders and staff of the four IAU Offices, who participated in planning the meeting. Last but certainly not least, a heart-felt thank-you to the IAU OAE staff who worked behind the scenes to get the event itself up and running, and keep it that way: Markus Nielbock, Niall Deacon, Anna Sippel, Asmita Bhandare, Eduardo Penteadó and, finally, Gwen Sanderson.

Markus Pössel
Director, IAU Office of Astronomy for Education
Heidelberg, September 9, 2021

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Schedule

Tuesday, July 20, 2021

11:00 - 12:00 UTC	Welcome & Introduction to the IAU Offices Family Meeting	
	Markus Possel OAE Director	Welcome
	Ewine van Dischoeck IAU President	Notes from the IAU
	Teresa Lago IAU General Secretary	The IAU Offices
	Kevin Govender OAD Director	Introducing the Office of Astronomy for Development
	Carolyn Liefke OAE Deputy Director	Introducing the Office of Astronomy for Education
	Lina Canas OAO Director	Introducing the Office of Astronomy Outreach
	Itziar Aretxaga ISYA Director	Introducing the Office for Young Astronomers
	Markus Nielbock OAE Coordinator	IAU Offices Family Meeting concept

Wednesday, July 21, 2021

07:00 - 07:15 UTC	Informal meet & greet	
07:15 - 08:15 UTC	Block session 1	
	Moderator: Robert Hollow - NAEC Australia Support: Tan Vu Nguyen - Co-NOC Vietnam	Meeting of Oceanian Southeast Asian regions
	Moderator: Nasser Alkadi - NAEC Syria Support: Tareq Alkhateb - NAEC Syria	Computing and electronics for teaching astronomy
	Moderator: Aysegül Yelkenci - NAEC Turkey Support: Dr. Zhu Jin - NOC China Nanjing	Organising teacher training events
	Moderator: Mayssa El Yazidi - NOC Tunisia Samir Dhurde - NOC India	Research in classrooms
08:15 - 08:30 UTC	Informal meet & greet	
08:30 - 09:00 UTC	Sessions summaries (Block 1) - Moderator: Kevin Govender (OAD Director)	
09:00 - 09:15 UTC	Informal meet & greet	
09:15 - 10:15 UTC	Block session 2	
	Moderator: Jin Zhu - NAEC China Support: Tan Vu Nguyen - Co-NOC Vietnam	Archival data for education
	Moderator: Farseem Mohammedy - NAEC & NOC Bangladesh Exous Sit - NAEC Hong Kong	STEAM Astronomy
	Moderator: Susan Murabana - NAEC Kenya Support: Frances McCarthy - NAEC & NOC Committee Ireland	Monitoring & evaluation
10:15 - 10:30 UTC	Moderator: Thilina Heenatigala - NAEC & NOC Sri Lanka Nadeem Oozeer - NOC Mauritius	Decolonising Astronomy Outreach & Education
	Informal meet & greet	
10:30 - 11:00 UTC	Sessions summaries (Block 2) - Moderator: Anna Sippel (OAE)	

Wednesday, July 21, 2021

11:00 - 11:15 UTC	Informal meet & greet
11:15 - 12:15 UTC	Block session 3
	Moderator: Paul Baki - NAEC & NOC Kenya Support: Mayssa El Yazidi - NOC Tunisia Meeting of African regions
	Moderator: Vegard Rekaa - NAEC Norway Gustavo Rojas - PLOAD Science Communication
	Moderator: Marieke Baan - NOC Netherlands Support: Marc Frincu - NAEC Romania NAEC, NOC, R/LOAD, OYA collaborations
	Moderator: Monika Jurkovic - NOC Serbia Angela Pérez - NAEC Colombia Outreach funding opportunities
12:15 - 12:30 UTC	Informal meet & greet
12:30 - 13:00 UTC	Sessions summaries (Block 3) - Moderator: Eduardo Penteadó (OAE, Coordinator)
13:00 - 13:15 UTC	Informal meet & greet
11:15 - 12:15 UTC	Block session 4
	Moderator: Salma Sylla - NOC Senegal Support: Abdelhafid Bani - NAEC Morocco Meeting of French speaking regions
	Moderator: Laura Trouille - North American ROAD Tan Vu Nguyen - Co-NOC Vietnam Citizen Science
	Moderator: Angie Barr - NAEC Chile Support: Beatriz Garcia - NOC Argentina Remote teaching & outreach
	Moderator: Mayra Lebrón - NOC Puerto Rico Ivalu Barlach Christensen - NAEC Greenland Amateurs astronomers
13:15 - 14:30 UTC	Informal meet & greet
14:30 - 15:00 UTC	Sessions summaries (Block 4) - Moderator: Eduardo Penteadó (OAE, Coordinator)
15:00 - 15:15 UTC	Informal meet & greet
15:15 - 16:15 UTC	Block session 5
	Moderator: Juan Angel - NAEC Spain Support: Melissa Solares Hidalgo - NAEC Guatemala Meeting of Hispanic regions
	Moderator: Ali Al-Edhari - NAEC & NOC Iraq Rulx Narcisse - NAEC & NOC Haiti Astronomy Awareness Kit
	Moderator: Anahi Caldu Primo - NAEC Mexico Support: Ndunge Roland - NOC Cameroon Teaching astronomy in insecure areas
	Moderator: Exodus Chun Long SIT - NAEC Hong Kong Andreja Gomboc - NAEC & NOC Slovenia IAU & outreach
16:15 - 16:30 UTC	Informal meet & greet
16:30 - 17:00 UTC	Sessions summaries (Block 5) - Moderator: Eduardo Penteadó (OAE, Coordinator)

Thursday, July 22, 2021

9:00 - 9:15 UTC	Informal meet & greet	
9:15 - 10:15 UTC	Block session 6	
	Moderator: Myriam Alqassab - NOC Bahrain Support: Maysa Elyazidi - NOC Tunisia	Meeting of Arabic speaking regions
	Moderator: NAEC & NOC Nepal Aniket Sule - NAEC India	Astronomy Olympiads
	Moderator: Thilina Heenatigala - NAEC & NOC Sri Lanka Support: Ivo Jokin - NAEC Bulgaria	Access to remote observing
	Moderator: Ma. Rosario C. Ramos - NAEC & NOC Philippines Support: Rosa Doran - NAEC Portugal & Portugese LOAD	Science education methods
	Moderator: Santiago Vargas Dominguez - NAEC Colombia Ndunge Roland - NOC Cameroon	Open source tools
10:15 - 10:30 UTC	Informal meet & greet	
10:30 - 11:00 UTC	Sessions summaries (Block 6) - Moderator: Lina Canas (OAO Director)	
11:00 - 11:15 UTC	Informal meet & greet	
11:15 - 12:15 UTC	Block session 7	
	Moderator: Olayinka Fagbemi - NAEC Nigeria Support: Manuel Grullon - NOC Dominican Republic	Astronomy education in low-income communities
	Moderator: Sara Anjos Tshiamiso Makwela - NAEC South Africa	Overcome gender inequality
	Moderator: Maysa El Yazidi - NOC Tunisia Support: Sarah Abotis-Masters - NAEC Ghana	Astronomy and careers
	Moderator: Nadeem Oozeer - NOC Mauritius Mamadou N'Diaye	Europe - Africa collaborations
12:15 - 12:30 UTC	Informal meet & greet	
12:30 - 13:00 UTC	Sessions summaries (Block 7) - Moderator: Samir Dhurde (NOC India)	
13:00 - 13:15 UTC	Informal meet & greet	
13:15 - 14:15 UTC	Block session 8	
	Moderator: Yasmin Catricheo Support: Carmen Pantoja NOC USA	Astronomy education & outreach in the Caribbean
	Moderator: Lundby Rekaa - NAEC Norway Nicolas Vasquez	Astrotourism
	Moderator: Kuntal Misra - NAEC India Support: Sarita Vig - NAEC India	Telescope network
	Moderator: Premana W. Premadi - NAEC Indonesia Support: Dr. Zhu Jin - NOC & NAEC China Nanjing	Education and outreach
	Moderator: William Waller - NAEC USA Sona Ehlerova - NAEC & NOC Czech Rep	Astronomical societies
14:15 - 14:30 UTC	Informal meet & greet	
14:30 - 15:00 UTC	Sessions summaries (Block 8) - Moderator: Alessandra Zanassi (OAE Center Italy)	
15:00 - 15:30 UTC	Plenary session	
	Markus Pospel - OAE Director Kevin Govender - OAD Director Carolin Liefke - OAE Deputy Director Lina Canas - OAO Director Itziar Aretxaga - ISYA Director	Meeting summary and farewell

Meeting of Oceanian Southeast Asian regions

Moderator: Robert Hollow (NAEC Australia)

Support: Tan Vu Nguyen (Co-NOC Vietnam)

This was an opportunity for participants from this region to meet, initiate collaborations and discuss a set of topics of common interest.

This session was an opportunity for IAU Office Family members from OAD, OAO, OAE and OYA from the South-East Asian and Oceania nations to meet, discuss common issues and challenges, identify priorities and develop some potential collaborations. Participants included representatives from Indonesia, Sri Lanka, Japan, Australia plus OAO from Japan, OAD from South Africa and OYA. This is a diverse region with many languages plus geographical and socio-economic factors presenting challenges.

Robert Hollow indicted regret that Australia was unable to welcome and host regional partners at the APRIM Meeting in Perth and the CAP Meeting in Sydney in 2020. The IAU General Assembly in Busan, South Korea in 2022 will hopefully provide an opportunity for regional members to meet in person. The next APRIM meeting will be in Koriyama, Japan in 2023.

COVID has had a major impact across the region. A positive from it though was, for example, the rollout of more reliable internet access across the many islands of Indonesia. Participants noted the move to and greater acceptance of online learning, outreach and communication. This will only grow in future and needs to be factored in as a standard mode for future initiatives and communication.

A major omission from the IAU family of offices is the lack of representation from nations in the Oceania region other than Australia and New Zealand and NAECs needed for Cambodia, Vietnam and Myanmar. An action item is for participants to try and identify potential NOC and NAEC contacts across the region.

Kevin Govender from OAD was curious about the low number of funding requests from Australia and New Zealand. Robert Hollow replied that these countries are generally able to fund projects internally thus not needing to draw on limited OAD funds. There is great potential for possible collaborations though with other regional collaborators for projects.

Avivah Yamani suggested that the 2023 total solar eclipse could provide an excellent opportunity for a regional collaboration given that it will be visible in Australia, Indonesia and Timor Leste. We recommend a follow up dedicated online workshop/meeting to start exploring possibilities for this.

We are keen to organise a regional IAU Office family Meeting that could be more time zone

friendly for participants and allow participants from all countries in the region to meet up. A related issue is the desire to establish on-going communication and collaboration channels for regional members. Whether this is arranged by each office or more casually by regional participants is yet to be resolved. We recommend an online meeting to explore interest in collaboration around the 2023 solar eclipse.



Computing and electronics for teaching astronomy

Moderator: Nasser Alkadi (NAEC Syria)

Support: Tareq Alkhateb (NAEC Syria)

In this session we discussed and exchanged experiences with including computer science, engineering and electronics in astronomy projects for students, and how can programming (e.g., Arduinos, Scratch, Python, etc.) or circuits enrich teaching.

We started with an introduction of ourselves, and the Syrian Astronomical Association and its activities held in the Syrian astronomical observatory; we explained through this introduction what are the traditional methods that we used to educate kids about astronomy and space science.

The first question was more of an invitation to attendees to share their screen and tell us about their own experience on this matter, did they use any kind of special software that they found joyful to educate kids using it?

We had a very small number of attendees but we had a contributor that wrote in the chat and after that came on to the stage area and told us about her experience using spectroscopy and fibre optics and software's that came with it, to teach kids about wavelengths and spectrum, she said they had a good time even though they didn't fully understand how the whole thing worked but they had a good idea about the subject in a fun cool scientific way.

We also introduced a website called quizone (quizone.me). This website is very interactive, it has a lot of tools for educators to use. We explained how it worked, and how we can play fun games with a lot of kids and at the same time educate them about many different subjects including astronomy in all its fields.

Another contributor wrote in the chat that they had a good experience using Stellarium, an application for mobile phones that can be easily used for observing nights to identify constellations, the position of planets, and practically anything related to the night sky.

Another example given was the software universe sandbox and its 3D graphics and literally sandbox that you can make scenarios of supernovas, black holes swallowing earth etc. These questions pop up a lot during activities and some kids have a hard time getting the idea, so them seeing it makes it a lot easier to imagine and comprehend difficult subjects.

We showed an example of a model of the solar system that was a gift given to us, a simple rotating table with rotating planets through small motors and wheels, the kids had so much fun with it and learned about the planets in a new, really exciting way.

A question we also asked on the chat: Is there "based on your experience" a certain age for kids to be able to handle and comprehend such methods of teaching? A funny yet fruitful response was that if you don't tell them, it's hard, they wouldn't know it. And that's true, sometimes we use some kind of materials for teaching that grownups have a hard time understanding it, and kids can get the main idea a lot faster, and that's due to kids these days are more familiar with technology such as mobile phones, computers. Simple not very complex circuit wiring accompanied by programming languages such as Arduino, or even a computerised telescope can be used to explain how computers can be used in action on observing nights to uncover the mysteries of our universe.

From the first part, we concluded that there is much software over the internet that educators can use, and kids can enjoy, Anyway, there are some limitations to these software's, you can't do everything with them, a lot of them are very expensive to some educators, which brings us to the second part: Hardware. There is a lot of room for development in this area, although it is a little harder to teach kids about them, the results are worth it and the sense of achievement is bigger. They are relatively cheap and with a single board and the same materials you can make different projects.

We took a look for a project about lunar craters for a very long time, and it was interesting to get to know about the hardware layout of the solar system in terms of sensations.

One of the subjects that we prefer to discuss in the future, following one of responses in the survey that we sent to participants, where they would like to know about projects on celestial mechanics, not just talking about a model of the solar system, but about software solutions for studying the motion of objects in the solar system. After all, no matter what you are using to spread the knowledge of astronomy, love and passion is enough to make people, young and old, fall in love with the sky.

Organising teacher training events

Moderator: Aysegül Yelkenci (NAEC Turkey)
Support: Dr. Zhu Jin (NOC China Nanjing)

This session was meant as a platform to exchange experiences and best practices for organising astronomy/physics teacher training events.

In this session the following topics were discussed:

The type of establishments that organise teacher training events in each country are usually universities, national astronomical society, institutions, or commercial firms. Astronomy is not a

direct subject in some countries and curriculum is not the same. But there are some common problematic topics (Seasons, etc.).

Sustainability is a common problem. Negotiations with the Ministry of Education may provide a sustainable approach for the events (Azerbaijan, Turkey). For example, astronomy teacher training may be included in in-service training program (Turkey). Organisers may partner with NASE (Network of Astronomy Schools) or GTTP (Tanzania). Funding for the training is provided either by the government, commercial partners, municipalities, or 3rd party institutions. Contents of the training may include observations, lectures and hands on activities. Trainings are offered in various time scales like hours, days and mostly over weeks or months for online training formats. Only few countries have a series of training with include remote observing in advanced teacher training. Organisers may go to schools for training (Ireland, Tanzania) but in some cases, teachers come to a training center (China, Turkey).

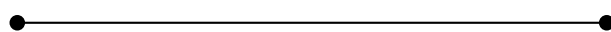
Resources in national language are necessary. Some counties provide online resources like China, some prefer hardcopy of resources like Ghana. Target groups may consist of science, physics, biology, geography, music, kindergarten, English language teachers and teachers to be. There are no teaching standards for astronomy teacher training. Outcomes may differ for each type of the training. The training objectives must be consistent with the curriculum.

Monitoring the teachers after the training in mostly informal. A few countries perform surveys and interviews. Like in Ireland, an external evaluator interviews participants over the course of a year to follow up.

Teachers are willing to receive a certificate they can use in their careers. It may motivate the teachers to take training but in some cases that may be fake motivation as well.

Online training sessions have been held in some countries like: Portugal, Turkey, Tanzania.

Teaching standards may be the next topic to discuss. Some kind of (national /international) accreditation may be helpful to reach the teaching goals. More sessions like this should be held to share experiences, to overcome main difficulties in organising teacher training and to form international collaborations.



Research in classrooms

Moderator: Mayssa El Yazidi (NOC Tunisia)
Support: Samir Dhurde (NOC India)

The session theme dwelt on how to get cutting edge astronomy topics into classrooms for everyone to share the excitement and maybe even to get inspired to take up contributing to the future knowledge via astronomy. Many participant colleagues were motivated by the same and thus wish to get research into classrooms at an earlier stage of learning, with syllabi changing

from being more like history of science to them including present stuff, especially astronomy and astrophysics — looking forward instead of backward and engaging students in research.

Some colleagues shared links to good “research in school” type of projects, especially IASC, which featured a lot in the discussion as a good example. There was an example of getting real data into mobile planetarium content. A set of high school projects to use XMM-Newton data archive and a project for students to request pictures from ISS for further study were also highlighted.

Then we came to the implementation and hurdles, which was the crux of the discussion. The major issue was how to take the projects to classrooms and how to get teachers to work along with the researchers. We agreed that they are the key role players in research reaching classrooms. However, it is not easy to convince them to go this extra bit given that there is either already a lot of teaching work or there are activities given to them by schools or higher authorities.

One of the ideas that came up was giving teachers credit/value if they do this. For example, they be involved in development, pilot trials, or extra training in developing some skills. This is possible for projects aiming at a few schools. For STEM teachers, we could also find concepts that are difficult to teach in their own curricula and help them with it. There are examples of success where teachers were happy to work with the outreach team to elaborate on astronomy portions in the syllabus, after they got help with other related Physics portions. They were even willing to collaborate on research level work with their students as part of their Science Club activity.

Often scientists connect with classrooms as a guest lecturer, which is a good intermediate solution idea. However, it was also pointed out that in such cases the teachers are made (or decide to be) just the event managers. To avoid this they could be offered extra training and maybe an outreach event, interactions with parents etc. as part of the same event (for free!).

One more important factor is to convince the policymakers/government to include astronomy in the syllabus as an interdisciplinary science. Its potential to increase the competence profile, innovation levels etc. of the students should be a key highlight. If we can take steps and design example projects that can show success (e.g. asteroid discoveries by IASC) outside school, maybe they will be convinced to put it in the syllabus.

Lastly, it was mentioned that simply putting up a list of exercises on a website is not adequate. The task is to get into classrooms and it will require institutes to put in extra support for in-person outreach. For this, there may also be a requirement for scientists to practise speaking in schools. IAU could maybe host a global training event/programme for early career astronomy professionals towards this end. Since this is an early session, there may be other related things that come up in the following sessions, which we should keep a watch for.

More good examples of productive school-level research work are set, they could convince authorities to bring more astronomy into the curriculum. These could be done outside classrooms to begin with, but there need to be dedicated, long-term efforts (like IASC). STEM teachers need to be treated as a key link in efforts to then successfully bring astronomy research to classrooms. Orientation for early career astronomy professionals to practise speaking in schools etc. is a requirement for a long term success in this direction.

Archival data for education

Moderator: Jin Zhu (NAEC China)
Support: Tan Vu Nguyen (Co-NOC Vietnam)

In this session we discussed how to use the huge archival data from large surveys and historic observations for astronomy education in the classroom and beyond.

Audience: 20 people from Vietnam, China, Australia, India, UK, Russian, Philippines, Syrian, Colombia, Netherlands, Iraq, Finland, Poland, Japan, and other regions.

Topics discussed: Availability and accessibility of data, especially for teachers. The case of ASKAP/SKA Australia are introduced. The problem of software tools is mentioned from teaching experience in the UK. Resources and simple datasets for training photometry.

Links for useful archival data and tools:

<https://data.csiro.au/collections>

<https://www.csiro.au/en/education/Resources/Educational-datasets>

<http://skyserver.sdss.org/dr16/en/home.aspx>

<https://voyages.sdss.org/>

<https://pulseatparkes.atnf.csiro.au/>

<https://handsonuniverse.org/ghou2021/>

<https://outreach.ozgrav.org/portal2/>

<https://www.ligo.caltech.edu/page/educational-resources>

<https://lco.global/education/>

https://nitarp.ipac.caltech.edu/page/other_epo_programs

<https://astroedu.iau.org/en/>

Some other topics mentioned in discussion: citizen science projects; Hands-on Universe software; target group age; time allocation in the classroom and fundings; astroEDU; global accessibility; common policy for open access to data; plate for planetaria and museum; clean datasets for educational purposes.

The online discussion on the topics is fruitful and sharing experiences between participants including astronomers and educators is important. OAE may collect the resource on their webpage.

STEAM Astronomy

Moderator: Farseem Mohammedy (NAEC & NOC Bangladesh)

Support: Exous Sit (NAEC Hong Kong)

This session focused on ideas to include interdisciplinary approaches from science and arts in astronomy education and outreach.

STEAM as you know is science, technology, engineering, arts, and maths all combined in a skillful approach to education, critical thinking, design and analysis. Adding 'a' to the well-known STEM theme, STEAM makes an appeal that goes beyond science and engineering and encompasses arts and humanistic disciplines. Astronomy, as you know, has been portrayed as 'gateway to science' at an early age. It has physics, chemistry, engineering, design, maths, geology, biology, hydrology, atmospheric chemistry – everything. Added to these, is Arts. The sheer beauty and appeal of astronomical images is self-evident. The OAE booklet Big Ideas in Astronomy (section 1.3) contains an important segment on arts. It emphatically mentions: "The universality of art and its intimate connection to culture, can thus be a powerful means to make people appreciate not only the innate beauty of celestial objects and phenomena, rather the knowledge we have acquired about them. This increases the worldwide interest in astronomy and promotes cross cultural understanding encompassed by the notion of being under one sky."

This has since been an important value-addition to astronomical education. During the meeting, we floated the following questions: What are you thinking about STEAM in astronomy? How do we enrich our classroom experiences in terms of astronomy as a STEAM subject? What are or could be the best practices in this regard? What design activities can we recommend for early childhood, primary school and middle school classes? STEAM projects for high-schools, any neat ideas? How effective can puppet shows be for astronomy teaching? Can culture memes help STEAM astronomy, or vice versa?

Five speakers were present and there were 18 viewers. Betlehem Bitala (Ethiopia), Prof. Robert Walsh (UK), Bonaventure Okere (Nigeria) and Katrien Kollenberg (Belgium) spoke on-stage. Each speaker emphasised on creativity, drawing, music to lure students through stories to science, to demystify natural phenomena from cultural baggage, to use culture memes in order to in-still science. Speakers identified that most outreach activities already use some form of art. A few examples of best-practices emerged – Ethiopian Astro-Bus, pin-hole camera project (Nigeria), sonification of stellar properties (Katrien), augmented reality (Robert) and astrophotography (Sit).

Adding 'art' to raw science makes things very attractive. Hence, speakers emphasised using drawing, art, paper craft, astrophotography, music, augmented reality, comic books, model making, puppet shows, and cultural themes to be included in STEAM approaches for astronomy outreach activities. Through STEAM activities creativity, analytical abilities, critical thinking abilities, and innovative mindset can be boosted. Various attractive applications, science activity boxes (Universe in a Box) etc. might help as STEAM tools in and outside classrooms.

Monitoring and evaluation

Moderator: Susan Murabana (NAEC Kenya)
Support: Frances McCarthy (NAEC & NOC Committee Ireland)

In this session we discussed why is monitoring and evaluation important and how do we do it?

We had representatives from a varied demographic in our session, including from Turkey, the Netherlands, Ireland, Italy, Kenya, Nigeria and Japan.

Why is it important?

- Identifying whether the project is under formal or informal astronomy education.
- It is important to know how the project is working because
 - Donors would like to measure the impact of the projects.
 - To secure future funding, a well documented report with KPIs is needed
 - It is a nice way to track the progress of projects

How to do evaluation and monitoring:

- Identify the goal of the activities which includes increasing content knowledge of participants and might influence behavioural change.
- Establish goals for the events in advance.
 - Then evaluate based on the topic/goal, e.g., using pre- and post assessment/evaluation.
 - Continuous feedback from participants with questions like what they liked and what can be improved.
- Outreach astronomy education
 - borrow ideas/techniques from the formal sector.
 - Involve a professional or external expert as a way of reducing the workload. This will also allow for feedback that is not biased

There are a number of organisations that have useful resources available for monitoring and evaluation. We recommend having a package developed with guidance for informal versus formal astronomy education. Here are some links with resources on Monitoring and evaluation:

1. Europlanet has a comprehensive toolkit for informal activities <https://www.europlanet-society.org/outreach/europlanet-evaluation-toolkit/>.

2. UNawe: <https://www.unawe.org/about/evaluation/>
3. The upcoming Shaw conference was recommended as a place to get more ideas: <https://astro4edu.org/siw2021/>
4. Also recommended were surveys that could be used over various time frames. Interviews. Concrete evaluation in formal education e.g., improvement in learning.
5. Images, drawings and concept maps used for pre- and post formative assessment
https://www.ucd.ie/teaching/t4media/concept_maps_assessment.pdf
https://repositorio.ul.pt/bitstream/10451/46862/1/Fariaetal_2019_Ed3-13.pdf

Decolonising Astronomy Outreach and Education

Moderator: Thilina Heenatigala (NAEC & NOC Sri Lanka)
Support: Nadeem Oozeer (NOC Mauritius)

In this session we discussed growing concerns on Western-dominated approaches and elitism's/hierarchical processes in communities, what a community of volunteers under IAU can do to decolonise these efforts and how can we further the development of astronomy outreach and education without 'colonial science' and 'parachute science' approaches.

Decolonisation is broadly about confronting how imperialism, colonialism, and racism have shaped our modern world and changing the mindsets and approaches of localised hierarchy and elitism. This session briefly introduced different aspects of colonisation and the postcolonial aftermath, how it is relevant to astronomy outreach and education.

Moderators presented examples in research, education and outreach. The large research programmes have the risk of lacking local expertise and representation. Sustainability and capacity building efforts are key to success for multinational large research programmes. Outreach activities are often at risk of 'quota filling demands for global agendas where it might not be relevant for local development and needs. It is necessary to look thoroughly into local needs and also collaborate with local expertise to avoid 'parachute science' outreach efforts. Colonial science further expands into curricula. Understanding the Western-Centric and Global-North glorified science is another key aspect, especially in the curricula, and re-design to include a range of non-western/global-north perspectives.

The participatory discussion touched many concerning areas, examples, and possible actions. It was discussed that apart from Western influence on East, Global North on Global South should be taken into account. Co-creation is crucial for this, especially to work with local experts. Decolonising should not be restricted to Global North or Western communities but also should be discussed by communities on the other end of the spectrum. A lot of the topics were also

discussed in a manner how IAU could take them into practice internally within the Offices and for their engagement with the volunteer community. What's needed locally is far more important than a global agenda that might not add any value locally. It was pointed out that there are issues even between Eastern and Western Europe. Session participants unanimously agreed that there should be more awareness and discussion on decolonising astronomy.

The session concluded with the following understanding and action items: a) there is a big lack of understanding in 'colonial science' and 'parachute science' efforts that makes it more the reason to create awareness among the IAU community, b) to put together a reading list on the topic for awareness, c) instead of removing Euro-Centric/Global-North Centric resources, re-design resources to have a better representation, and d) discuss with OAD on annual project proposals criteria to take decolonisation aspect into account.

Meeting of African Regions

Moderator: Paul Baki (NAEC & NOC Kenya)

Support: Mayssa El Yazidi (NOC Tunisia)

This was an opportunity for participants from this region to meet, initiate collaborations and discuss a set of topics of common interest.

Due to some unforeseen circumstances, the appointed moderator and support were not present for this session. We also had some technical glitches that delayed the session discussion by over 15 minutes. The moderators mentioned above stepped in and carried the discussions. The panellists presented a summary of activities in Western Africa, South Africa, Tanzania, and Ghana. We discussed the plan of action that is required for the readiness for the IAU GA 2024 in South Africa. These plans include strengthening collaborations at all costs within Africa. However, collaboration amid African countries and even within the countries are complex and are not working to their full potential. One of the blockages is the African system's hierarchical structure that prevents the new generations from achieving. We need a change in mindset to create a critical mass of people who are willing to find time, sacrifice, and keen to help and grow.

We further found that materials are not always readily available, and currently available materials used in many African countries are outdated and need continuous reviews. There is an urgent need for a common platform that can help to co-create tangible solutions for Africa. AfAS can be the point of contact to provide such a platform.

For Africa to succeed in this digital age, we will need to address some issues such as Internet connectivity that is lacking and familiarise the trainers with up-to-date technologies.

Overall the session went well, and we could reach the goals and objectives. The key take-away point is the need for a common platform to co-create tangible solutions for Africa. Furthermore, there is a strong need for training people management on top of Astronomy.

Science Communication

Moderator: Vegard Rekaa (NAEC Norway)

Support: Gustavo Rojas

Speakers: Markus Nielkbock, Aniket Sule, Avivah Yamani, Raj Kumar Dhakal

Participants: 20

The discussion centred around what is the essence of good science communication? How can we improve our skills? Science Communication is understood as a combination of education, journalism and conversations on the topic of science, and in particular astronomy and astrophysics, for this session.

Teachers are the first (and to many the only) Science Communicators young people meet, and therefore the most important we can target with their science communication. Secondly, journalists are a group we should both learn from, but also support as they convey science to many people already. If we are able to strengthen both teachers' and journalists' understanding of science and astronomy, we will, through helping these groups, reach out to more people than we can do on our own.

As science communicators, we must meet the preconceptions of the audience, with understanding rather than confrontation. Some groups will perhaps not like to discuss philosophical topics like the creation of the universe but will be very interested in learning how to understand and predict eclipses or the physics of the Sun. It is important to not see the understanding of the audience as misconceptions, as their understanding is their reality. Failing to do so, might cause them to ignore our message completely. We can also reach many people by working on different platforms, like creating TV series (for YouTube, Netflix, etc.), through images and art, and so on. Regardless of what platform you choose, science communication requires training.

All science communicators should try to ask themselves "How do we know this?" with and in front of the audience. Concerning the discussion on science communications for religious groups, the following experience/view was shared with the group: "I usually try to explain the different point of view between science and faith before I give the scientific explanation". Collaboration with religious groups/communications should be encouraged, e.g., Muslim interest in finding the exact date of the new moon has encouraged several interesting science discussions between religious people and astronomers.

Comments on Science journalism during the session: "What we need more than ever is trained science journalists to be able to write about the difference between science and pseudoscience in the media at their disposal". "I think the collaboration between astronomer/teacher with science journalist is very important, the level of communication is different but important". "Science journalism has an important role and responsibility". "I think the IAU now needs a science journalism working group to discuss the importance of this role and bringing in astronomers and communicators in this field".

NAEC, NOC, R/LOAD, OYA collaborations

Moderator: Marieke Baan (NOC Netherlands)

Support: Marc Frincu (NAEC Romania)

This session aimed to find ideas and tools for collaborations and exchange between the regional coordinators (NAECs, NOCs, R/LOADs, OYA) of the various IAU Offices.

There were 20 attendees in this session. Based on a poll on Hopin, most of them reported to already have established a form of collaboration between NOC(s) and NAEC(s). According to the poll most of the participants are NOC or NAEC. The discussion then continued with a debate on outreach versus education and the relation between NOCs and NAECs and if their roles overlap and how they collaborate.

The participants agreed that formal education is something completely different than public outreach or press communication. But there are also overlaps, for example, in the field of informal education and outreach. Working together in those fields can have benefits, because in many projects or activities we need communication and education skills to make them successful. This is the case for outreach/education projects and activities that have more or less the same goals.

In some countries the NOC and NAEC work within the same organisation or office. In that case, it's very easy and obvious to work together. Especially in countries or regions with professionally funded communication groups, it is much easier though than in countries or regions where there is less or no funding for the NOCs and NAECs. The differences between countries are clear. Difference in infrastructure, FTE's, needs, goals, etc. That makes it difficult to develop tools. On the other hand, discussing such a topic with each other is inspiring, you always learn from each other and can get new ideas. The connection to the R/LOADs and OYA is weak or not existing in all the countries and regions that were represented in this session.

Outreach funding opportunities

Moderator: Monika Jurkovic (NOC Serbia)

Support: Angela Pérez (NAEC Colombia)

Possible funding sources for hiring personnel and purchasing equipment for outreach projects covered by NOCs and R/LOADs were discussed during this session.

During our session we had between 10 and 14 participants. Angela Pérez (NAEC Colombia) prepared a presentation of her successful OAD funded program "Classroom under the stars". She shared that it was very important for her to have a clear idea, test the idea with teachers and students to get the funding secured. Suresh Bhattarai (NAEC & NOC Nepal) spoke about

the two OAD funding schemes that he has secured, one in 2018 and the second one in 2020 through the Astronomy for All COVID-19 program. He has had funding additionally obtained from the National Academy of Sciences and Technology of Nepal, which is also crucial in drafting the overarching policy of the outreach programs. He has also had local funding secured from enthusiasts who are willing to give money. These funds are then turned back into programs that are of interest to this group. Both Angela and Suresh have emphasised the importance of in-kind support (which is not specifically money): connection between the members of the community, help with some equipment, e.g., free venues for lectures. Daudi salehe Mdoe joined the conversation agreeing on this point.

A question of crowd-funding efforts was raised. The conversation led to the conclusion that regardless of which platform one uses it usually works for one specific event/project, and it is not sustainable. Ramasamy Venugopal, from the IAU Office of Astronomy for Development, joined the conversation. It is important to keep in mind all the legal restrictions and tax laws of various countries. In the chat Genevieve Marshall, IAU's Fundraising Officer, has joined us. In the chat numerous resources (links) for fundraising opportunities and information about it were posted, and here are some: <http://t.co/xxaXGON1tB?amp=1> is the Youtube link for the OAD fundraising session, slides from the Fundraising Workshop by Genevieve Marshall: <https://www.dropbox.com/s/jomz88sf810mbix/Projects%20Fundraising%20presentation%2026%20Feb%20no%20notes.pptx?dl=0> from the 26th of February, 2021, <http://en.unesco.org/countries/national-commissions> and all the resource from the EU funds, also look for the funding schemes that are available in your country from different embassies (USA, Japan, Norway, Germany, Bulgaria, Turkey...) and specifically in Europe there is the Visegrad Fund (<http://visegradfunds.org>).

Angela has pointed out that building trust in the community and making a net of people who would work in the same direction is as important as money. This network can be used to exchange ideas, brainstorm, solve problems, etc. When we discussed which are the big item things on one's proposals most commonly it was a big equipment piece, typically a telescope, but also the travel expenses and logistic costs when going to far, hard to reach regions. Angela has pointed out the importance of sustainability. All of our programs should be somewhat permanent or at least planned for a long-term implantation. This is a serious problem, since most funding schemes are limited to specific one term projects. Suresh had good experience with having put together a business plan for their activities in Nepal, and with the help of that plan self-sustained the outreach effort. It is always good to get a kick-start from a project, but to maintain the program it needs a long-term plan, almost like a business. Monika has added that she would like to see options on these funding schemes for paying something for the volunteers.

We propose to the IAU to prepare, for all the NOC, NAEC, ROAD, LOAD leaders, a list of fundraising sources (especially international ones) that could be used by all of us, and to provide some training in how to do this. The sustainable funding for any and all outreach effort is uncertain, and it makes long term work quite hard.

Meeting of French speaking regions

Moderator: Salma Sylla (NOC Senegal)
Support: Abdelhafid Bani (NAEC Morocco)

This was an opportunity for the IAU Office Family members from French speaking countries to meet and discuss a set of topics in their own language and for initiating collaborations.

1. Why is there a low representation of french speaking regions in the IAU?

Barriers:

- Low availability of resources and information in French language compared to English
- Lack of job or business opportunities in the field of astronomy
- The total number of people speaking french in the world is way lower than those speaking English, therefore we need to compare ratios instead of totals

Solutions:

- Setting up a network of French-speaking countries to help each other
- To create a group of francophonie around astronomy
- Exchange with the Regional Bureau of Astronomy for Development (such as the one in West Africa led by Bonaventure Okere) on the issue
- Organise bilingual training courses
- Translate the IAU newsletter into French
- Share resources in French (<https://www.fondation-lamap.org/>)
- Do more education and outreach activities in French-speaking countries where professional astronomy is not yet present

2. Lack of financial support for outreach astronomy activities in the french speaking regions. This reduces the number and impact of these activities. It is rare that a french speaking country gets access to financial support in the IAU projects

Solution: making projects together by building on the strengths of each participating country

3. Filling the NAECs gap in some French-speaking countries: Not all the French speaking countries gave their NAECs

Barriers:

- The language is a barrier that prevents some people from participating
- lack of knowledge of the NAEC network

Solutions:

- Use social media to reach more NAECs
- Use the Network of friends
- The NOCs can help to create NAEC in their countries
- use the channel of the French online journal l'Astronomie Afrique (<https://lastronomieafrique.com/>) to publicise the NAEC network

Conclusion and Outlook:

1. Motivate people to work together to increase chances to win some projects launched by the IAU
2. Encourage bilingual training (in French and English)
3. Invite the NOCS to create the NAECs in their countries
4. The French speaking countries who already have their NAECs can search for astronomy passionate people in the countries without NAECs and help them to volunteer to be NAEC



Citizen Science

Moderator: Laura Trouille (North American ROAD)
Support: Tan Vu Nguyen (Co-NOC Vietnam)

Citizen science is a research tool (unlocking large data sets), an education and public outreach (EPO) tool (engaging students and the public in meaningful and valued ways in real research with researchers), a tool for economic development, and a tool for environmental sustainability.

In this session, we discussed opportunities, challenges, and best practices in engaging in citizen science through the OAE, OAO, and OAD efforts.

There is clearly great interest in how to utilise citizen science in our office's efforts, with 24 session participants, many of whom have already tried different ways of integrating citizen science. While many citizen science programs are designed to have a low barrier to entry so that anyone can participate (e.g., Zooniverse projects don't require any specialised background knowledge or expertise), they also often hold opportunities for advanced students to gain research experience and connect directly with professional astronomers. For example, in addition to the [PlanetHunters.org](https://planethunters.org) main task of looking for dips in light curves, participants can also participate in an advanced task of helping to [vet exoplanet candidates](#) by examining the full light curves and additional publicly accessible data in the [MAST](#) archive. Participants are encouraged to connect with the Planet Hunters researchers both through the project's discussion forum and through their weekly [Coffee Chat](#) YouTube program.

Citizen science professional umbrella organisations include <https://citizenscience.org/> and <https://ecsa.citizen-science.net/>. An open science, open source, and open data ethos infuses these efforts, including making citizen science research tools publicly accessible and free when possible. For example, Zooniverse provides a free DIY Project Builder platform (see <http://zooniverse.org/lab>), enabling dozens of research teams each year to launch their own crowdsourced research projects and engage the over 2 million participants worldwide in their research.

In recent years, funding in a few regions around the world has increased for citizen science (e.g., in the U.S. the Crowdsourcing and Citizen Science Act of 2017 ushered in new federal funding opportunities and support, in Europe the Horizon 2020 program included significant funding for citizen science efforts, and Ireland's main funding body just added citizen science as a priority area). However, funding staff to support EPO efforts in general, including for citizen science, remains difficult worldwide. In addition, one participant noted that citizen science sometimes has an additional difficulty when the funder deems it 'too research-y' or 'too education-y', and thus not a good fit for their solicitation. This highlighted the importance of finding the right framing for a proposed effort; i.e., if the solicitation/funder has a research focus, best to frame your citizen science program mostly in terms of its research impact and have research partners on your team, whereas if the solicitation has an EPO focus, best to focus most of the proposal on the impact on the public.

This conversation also led to the advice that if you are just starting to explore citizen science as an option for your OAE, OAO, or OAD efforts, first see if what you are looking for already exists. It is a waste of valuable resources to start from scratch. Try a first iteration/experiment integrating your community into a citizen science platform that is already running, learn from that experience, and build from there.

There is tremendous opportunity for the OAE, OAO, and OAD offices through citizen science. Please click [here](#) for a list of citizen science resources and [here](#) for the session presentation slides.

Remote teaching and outreach

Moderator: Angie Barr (NAEC Chile)
Support: Beatriz Garcia (NOC Argentina)

In this session we discussed opportunities that exist to access remote observing facilities and robotic telescopes for education and outreach. The topics covered were:

1. Remote use of telescopes, the offer of remote telescopes and the great use that they provide and where anyone in the world can sign up (Andy and Robert shared resources listed below).
2. Online Programs, advantages, and disadvantages: Participants shared pandemic experience.
Some advantages: reaching more people, and online activities can be for the whole family.
Disadvantages: internet connections, not all the students have laptop, only cell phone and this makes it difficult many times.
Robert Hollow: covid has forced us and schools and students all online, we moved our PULSE@Parkes program online, so reached schools across Australia rather than just in Sydney
Gustavo Rojas: last year NUCLIO organised two online astronomy teacher training workshops in partnership with the IAC and ESA. We found that the online format allowed the participation of the teachers from regions of the world that could not attend the face-to-face meeting
Sarah Abotsi-Masters: I think online teacher participation varies tremendously from place to place. In Ghana it is still very difficult for teachers to be online.
3. Educational Material adapted to each region of the planet and in the local languages. Do the participants have the resources to continue to join online activities though? Especially in developing regions?
Robert Hollow: Yes Angie, many online activities show sky from Northern Hemisphere perspective and often teachers are unaware of this.
Thilina Heenatigala: In Sri Lanka, we are (almost) at the equator. None of the hemisphere-related, seasons-related educational activities are useful. Yes Thilina, same here in Ghana!!
Nicola Loaring: Big problem with phases of the moon as well!
Robert Hollow: I had suggested that one of the tags on AstroEdu resources indicates if it is all sky, Northern or Southern hemisphere or Equatorial and also include an exclusive label with online activities.

Outlook: Educational material adapted to each region of the planet and in the local languages, online activities continue after the pandemic, in addition to everything we have now, in most of the cases there is more access to assist to the meetings like that.

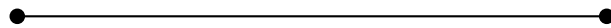
Some resources shared:

Robert Hollow: <https://pulseatparkes.atnf.csiro.au/> but this is our current website which is quite old, currently working on a completely new website. Useful list of programs for

high school students using real astro data https://nitarp.ipac.caltech.edu/page/other_epo_programs

Andy Newsam: If anyone would like to play with our telescope, please feel free to sign up on www.schoolsobservatory.org as an "NSO User" and try it out.

Beatriz Garcia: A complete online course on Didactic of Astronomy (Network for Astronomy School Education) www.naseprogram.org



Amateurs astronomers

Moderator: Mayra Lebrón (NOC Puerto Rico)

Support: Ivalu Barlach Christensen (NAEC Greenland)

The astronomy outreach work of amateur astronomers is significant and pivotal for bringing astronomy to everyone. But amateurs carry out the titanic work of self-preparation in the area of telescope observations, knowledge of the night sky and astronomy. What alternatives do amateur astronomers have for training and improving their astronomical knowledge?

Amateur Astronomers have a significant and pivotal role in bringing astronomy to everyone. They are the bridge between professional astronomers and possible future astronomers, making astronomy accessible for everyone; from stargazing events to creating events introducing astronomy and professional astronomers, etc.

The aim of the session was to learn about the needs of amateur astronomers and to discuss new ways that IAU, professional astronomers and amateur astronomers could support each others. The session had about 15 attendees.

Amateur astronomers are a very wide community with diverse interests and needs. Some countries shared their experiences. In China, astronomy has gained more relevance and interest after the IAU International Year of Astronomy 2009, and the public outreach has increased. In the USA, amateur astronomers with at least some college-level astronomy education have good astronomical concepts (<https://access.portico.org/stable?au=pgg3ztf9k59>), but more opportunities for sharing experiences and best practices on astronomy outreach are lacking. In Germany only 4% amateur astronomers are female. In the USA the amateur community has also low female participation. Outreach in Iran has increased in the past 3 decades, where there is a large attraction from females, resulting in an average of 60% female in amateur astronomy. In Italy, there is a large amateur astronomy community with two main focuses: dark sky protection and outreach with schools, but a strong connection between the amateur astronomers is missing. In India, there are sub-groups of areas, that have calls for action, where they figure out what activities can be done. During the pandemic, some of these sub-groups have successfully introduced astronomy projects where amateur astronomers can contribute.

The following suggestions and remarks were made during the discussion.

- There is a need for settings or platforms where amateur and professional astronomers could interact, share experiences and discuss best practices in outreach and education. For example, seasonal (virtual) meetings between amateur astronomers and professional astronomers could be facilitated by IAU.
- There is a need for more research projects where amateur astronomers could collaborate with professional astronomers.
- There is a need to address the gender disparity in the community of amateur astronomers since in many nations female amateur astronomers are very few.
- It is highly desirable to hold global outreach events since they stimulate collaboration and promote the flourishing and strengthening of groups of amateur astronomers at the national and international level.
- There is a need to strengthen cross-border amateur activities, necessarily not just stargazing.
- It is highly desirable to repeat (perhaps make it recurrent) the “Day of the Amateur Astronomer” that was held in 2019 for the IAU100.
- It is highly desirable to have a conference for amateur astronomers to encourage national and international cooperation and to share ideas, facilitated by the IAU.

There is an existing working group within the IAU aiming to bridge amateur and professional astronomers, https://www.iau.org/science/scientific_bodies/working_groups/330/members/. The amateur astronomers, who attended this session, shared contact information to increase cooperation.

Meeting of Hispanic regions

Moderator: Juan Angel (NAEC Spain)

Support: Melissa Solares Hidalgo (NAEC Guatemala)

This was an opportunity for participants from this region to meet, initiate collaborations and discuss a set of topics of common interest. During the meeting, there were approximately 14 participants as NAECs and NOCs from the following Hispanic regions: Spain, Guatemala, México, Puerto Rico, Argentina, Chile, Dominican Republic, Panamá and Colombia. Topics of discussion included the role of participants and experience in the development of Astronomy Education in each country. Some aspects that stood out were the need for resources that are designed for each region or are flexible enough to be adapted to the sky and context available. The need for designing, developing and sharing of educational resources in Spanish is also necessary.

There was a conversation on how Astronomy is promoted as part of events open to the public, like a day in which Astronomy Clubs and Associations collaborate in México to organise a national stargazing night in more than 120 sites around the country. This event is called La noche de las estrellas, the Night of Stars, and has been done the same night as other Latin American countries like Colombia. Other events like workshops for primary and secondary education teachers are organised in collaboration from NOCs and NAECs in some countries; Spain, Colombia and Dominican Republic, for example. There are also various conferences and congresses organised in almost every country that was represented in the session; Chile just had its first National Congress for Astronomy Education.

Lastly, there was emphasis on the importance of a Hispanic Region Network in which NAECs and NOCs share resources that are helpful in their countries, like the use of remote observatories or structured Astronomy curricula that has been approved or implemented in schools and educational systems. As a way of a first attempt at building this network, a [spreadsheet](#) was filled out during the session, which included highlights of participants' work in their countries and a place for email and contact information. This was shared and participants bookmarked the link. An opportunity for a follow up Hispanic Region meeting throughout the year was discussed and agreed upon.

There are multiple professional profiles that make-up the NAECs and NOCs in Hispanic regions, from college professors and research specialists, astronomers and experts on promoting astronomy, to high school teachers and organisations that collaborate to train and prepare teachers. More than the need for translating resources for Hispanic regions, there is a need for the creation of adaptable and flexible educational material to the context, culture and overall reality of each country. There is an agreement upon all participants that a follow-up meeting will be scheduled for this current year, as an opportunity to start collaborating on projects that respond to the discussed problematic and needs.

Astronomy Awareness Kit

Moderator: Ali Al-Edhari (NAEC & NOC Iraq)

Support: Rulx Narcisse (NAEC & NOC Haiti)

The idea is that each NOC should have access (owned, shared or by lending) to basic equipment for promoting astronomy to the general public. It may even be useful for integrating it into school, which argues for collaborating with NAECs. What are the crucial aspects to consider, and what kinds of funding are available?

The session began with an introduction by the Moderator Ali Al-Edhari on the importance of raising awareness of astronomy and how to use the attraction of astronomy to raise awareness of other sciences in general. To achieve this goal, we need tools (Awareness Kit). At this point the discussion was opened and there were interventions from representatives of a number of countries such as India, Iraq, Canada, South Africa and the United States, which focused on how to use low cost tools or how can they be manufactured locally.

All the attendees agreed that the main obstacle is the lack of financial means and the absence of specialised institutions that provide financial support to provide the necessary equipment for astronomical awareness. Therefore, we suggest the following:

- 1) Creating a prize called (Astronomy Awareness Kit), which contains, for example, telescope, Earth balls, digital camera, and projector.
- 2) If creating a new prize is difficult, we suggest developing the existing prize, e.g., Telescopes for All and transforming it into an Astronomy Awareness Kit.



Teaching astronomy in insecure areas

Moderator: Anahi Caldu Primo (NAEC Mexico)

Support: Ndunge Roland (NOC Cameroon)

In this session we discussed strategies to pursue astronomy outreach and education in insecure and potentially life threatening areas.

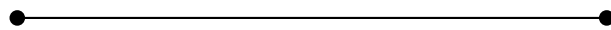
The round table began with an insightful discussion on the definition of an insecure area. The first thing that comes to our minds is thinking of insecure areas as those affected by wars or drug dealing, problems that colleagues in Kashmir or Mexico face. However, in the discussion it became clear that insecurity areas might have different faces and shades. A clear example is when women, or girls, are not able to attend activities because their parents think it is insecure for them. Insecurity can be present for a very specific group of people. It might also happen than in regions where racism is an issue, people of a certain skin colour might feel insecure by attending outreach or educational activities.

When this broader definition of insecurity was put on the table, it was clear that insecurity does not necessarily happen in a far away place, it can be just around the corner. Even in first world countries, like Belgium, where we might think insecurity is not a big issue, it came up that some neighbourhoods are considered more problematic and this bias might affect outreach activities and prevent people from these neighbourhoods from participating from an equal stand. It was also discussed that the meaning of insecurity might be very different from people within the astronomical community, which is very diverse. We come from different backgrounds, different realities and communication is essential to understand where we are standing and to be empathetic and understand what insecurity means to the people we are addressing and to the colleagues we are working with.

Finding solutions for insecurity issues in outreach activities is not straightforward. A solution that might work in one case, for example, scouting groups that could escort girls to some activities, might be very dangerous in other cases, for example when dealing with drug dealing cartels controlling highways, and might even be counterproductive. The best solutions can be worked out only by having a very good communication with the people we want to address and who live in the areas considered insecure. Working together and creating bonds is the best way to build together the mechanisms that can help us address the particular insecurity issue.

Finally, it was also mentioned that people doing astronomy outreach are not necessarily well trained in dealing with specific issues regarding the insecurity areas. However, this should not be a limitation to doing outreach.

As a conclusion, we should rethink this broader definition of insecurity when carrying out outreach and educational activities to ensure that we are not letting anyone out. Partnerships with people more involved in studying the sources of insecurity can be very helpful to find sensible solutions.



IAU and outreach

Moderator: Anahi Caldu Primo (NAEC Mexico)
Support: Andreja Gomboc (NAEC & NOC Slovenia)

The International Astronomical Union represents the professional astronomical research that generates new knowledge with 4 main offices targeting different regional needs around the world. Considering the unprecedented incident of the COVID-19 situation, it changes our behaviour on astronomical research and science communication. It is, therefore, crucial to have a conversation on how we could evaluate the efficiency of IAU Outreach by sharing experience from collaborations and projects.

1. What type of collaborations exist with IAU outreach in your country?
Jin Zhu shared the situation of mainland China that there are lots of astronomers from universities and observatories who are focusing on professional research. In the past

few years, due to the popularisation of science communication at the National Science Museum, more people started their engagement in outreach works.

Exodus mentioned a different situation in Hong Kong. They are lacking professional institutes or agencies about astronomical research, but usually, the astronomy ecosystem is formed by amateur astronomers and astrophotographers. And the local museums and NPOs are only served for educational or entertaining purposes.

Andreja Bomboc shared the situation in Slovenia that there is a lot of astronomy-related video sharing in social media with professional astronomers. But the limitation would be the two-sided translated materials on educational purposes (from IAU / from local societies), some popular cultures that might not be able to translate or face language barriers on useful materials seek IAU translators from local communities

2. What do you think about the purposes and functions of IAU Outreach?

Some local observatories are operated / managed by non-professional astronomers (the general public is interested in astronomy), which needs our support. And even the professionals might be outside IAU, such as International Planetarium Societies and Astronomers Without Borders keep in touch with international organisations to find potential astronomers

3. How can the IAU best bridge the link to outreach promotion?

In the social aspect, it would be helpful to connect with the local astronomy community with the government's support. The leading role in regional services has to strike a balance between professionals and educators, so that we might truly understand the actual needs or interests (learner-centered, NOT astronomer-centered) of the general public when promoting astronomy. Considering that mostly astronomy outreach is volunteer-based, we can consider some incentives to reward and maintain young professional's engagement (e.g. feedback, CV on career)

4. Can online media help spread the latest knowledge?

There is an interesting point discussed that new media is no longer at the national level, but individual level (such as articles and podcasts). Young professionals are able to have abilities in science communication and talk to people during outreach activities; unlike traditionally astronomers that were only conducting scientific research.

5. What if COVID-19 may not go away, any alternative approaches?

Besides 3-minute short videos or lectures that are being delivered, we can continue the online open resources or COVID-19 related projects launched by the IAU. Sidewalk astronomy does not necessarily require a telescope, but our naked eyes can still be a "camera" to enjoy the night sky. Astronomy should be practically learned by observation, which is more important than reading books.

Due to the limited time, we shifted to the discussion of artificial satellites affecting our night sky observation. Currently, we have the IAU Dark Sky Ambassador, and there are pressing needs that astronomers (IAU Outreach) might focus on their own research, but easily overlook the importance of dark sky protection (environmental aspect). Probably in the future, we can consider some IAU global events after IAU 100 (targeting special themes) or annual festivals with citizen science projects, cooperating with organisations from other disciplines.

Meeting of Arabic speaking regions

Moderator: Myriam Alqassab (NOC Bahrain)

Support: Mayssa Elyazidi (NOC Tunisia)

This was an opportunity for the IAU Office Family members from Arabic speaking countries to meet and discuss a set of topics of common interest and initiate collaborations.

As per the suggestions we received on Microsoft Form, we decided to choose four topics:

- **Collaboration:**
Based on how they discussed their problems, I noticed that the networking platform is their main issue; They are new to Basecamp, and there are only a few who have no problem using it. I even noticed that, during my one year as NOC Bahrain, only a few NOCs from approximately 14 Arabic countries on Basecamp are active: Bahrain – Qatar – Tunisia – Lebanon – Iraq. So, to come up with a solution to this matter, the six participants decided to create a WhatsApp group, and invite coordinators from all IAU offices to discuss future collaborations. I understand that WhatsApp is not professional or handy for some, but it appears to be the most comfortable way of communication in the Arab region. Now we have 15 members in that group from OAE, OAO offices. I even shared the surveys with those who could not attend the session.
- **Training:**
During the session, participants discussed the need for training in a variety of fields, including teaching training and training in activity demonstrations, and they all agreed that public relation is a challenge, while IAU office coordinators are well educated, experienced, and skilled in event management, it appears that training in public relation is needed.
- **Schools & Astronomy and Permits & Recognition letters:**
According to the survey, most Arab coordinators do not have permits to organise activities for government schools, also contacting government schools is difficult, whereas private schools do not require permits and they welcome collaborations with everyone for the sake of education. The coordinators have also agreed that a recognition letter from the IAU would make it easier to approach government schools. During the summary session, Markus and Lina mentioned that the OAE & OAO Offices do issue recognition letters, but apparently, no one is aware of that, which I attribute to a language barrier and lack of communication.

Due to the Eid holidays, the majority of the Arab region coordinators, members, and representatives were unable to attend the session, while some were unaware of the meeting and where it will be held, so we had to proceed with the session with six participants only.

Astronomy Olympiads

Moderator: Suresh Bhattarai (NAEC & NOC Nepal)

Support: Aniket Sule (NAEC India)

This session focused on exchanging opportunities and experiences of Astronomy Olympiads to engage teenagers with hands-on astronomy.

As a part of discussion, we did a quick survey where 32 countries affiliated with IAU Offices had responded. The countries that participated in our survey were Algeria, Argentina, Austria, Bolivia, Chad, Colombia, Croatia, Czech Republic, Denmark, Egypt, Ghana, Guatemala, Hungary, Hungary, Kenya, Lithuania, Mauritius, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Serbia, Slovenia, Syria, Tanzania, Togo, UK and the United States respectively.

Participants in the session shared the status of astronomy education in their country. They also shared about the different types of Olympiad and their formats in their countries. Many countries who organise Astronomy Olympiad and participate in regions such as in Latin America or Asian Pacific Astronomy Olympiad (APAO) and International Astronomy Olympiad (IAO) or International Olympiad on Astronomy and Astrophysics (IOAA) etc. do not have formal astronomy in the school curriculum. Participants highlighted that having astronomy in school is an advantage to inspire kids towards their career in the STEM field. Some of the participants shared their story on how astronomy in their early school motivated them to pursue their career in astronomy and become a professional astronomer.

Participants from Romania shared their plan to start IOAA-junior in 2022, if the pandemic situation is under control. They shared that they planned to start such an event in 2020 but could not organise it due to COVID-19. This Astronomy Olympiad for juniors will be open to students below 15 years of age, from all regions of the world and it can possibly motivate them to pursue their career in astronomy. Moreover, teachers will find more opportunities to engage their students in astronomical competition at national, regional and international levels.

The discussion also revealed that some of the countries do not have national programs, yet they have international participation and are doing good. Participants in the session discussed the power of collaboration to foster sustainable astronomy Olympiad communities in countries via knowledge sharing. In order to identify the status of formal/informal astronomy education and the status of Olympiad programs, participants discussed the importance of a global survey this year. Participants agreed that such a survey will be the baseline for the planning and execution of the astronomy Olympiad program in their respective countries. They also discussed how it helps to create a collaborative environment in regions or territories.

Survey: Participants agreed for the need of global survey to map the astronomy Olympiad status at national, regional and international level.

Teacher Training: Participants highlighted the need and importance of teacher training program for effective astronomy Olympiad programs in their countries.

Collaboration: As there were countries who have long experience of hosting astronomy Olympiads and countries who have not started a program, countries with expertise showed interest to share knowledge to help others to organise national programs.

Access to remote observing

Moderator: Thilina Heenatigala (NAEC & NOC Sri Lanka)

Support: Ivo Jokin (NAEC Bulgaria)

The session aimed for a discussion on existing opportunities to remote observing facilities and programmes for Education and Public Outreach (EPO). Prior to the session, the moderators ran a survey among NOCs and NAECs to find out awareness and engagement with remote observing. 53 people responded. 55% have engaged in EPO using a remote facility. 40% are currently using a remote facility to do EPO. 17% said that they are not aware of any remote facilities or programmes.

The discussion started with a brief overview of current remote observing facilities and programmes. Both coordinators shared their experience with research, education and outreach. It was understood that remote observing facilities are used for three key outcomes; obtaining nice photos as a fun-learning activity, learning to use tools to do real-research in classrooms, and producing results to publish.

Remote observing has enabled accessibility to conduct real-research in classrooms or at home. It has also helped to overcome the barrier of lack of resources in remote or under-developed areas. Not only at school level, but also at university level, remote observation is a great tool to run research projects. Some examples were shared on using remote observation for teacher training, where teachers learn how to run small projects for school students.

The discussion concluded with the understanding that a considerable amount of remote observing facilities and programmes already exist and they can handle more observations. However, more observations means that the cost of running the facilities also goes up. As an action item, the group recommends creating a list of existing remote observing facilities and programmes to be circulated among IAU NOCs and NAECs.

Science education methods

Moderator: Ma. Rosario C. Ramos (NAEC & NOC Philippines)

Support: Rosa Doran (NAEC Portugal & Portugese LOAD)

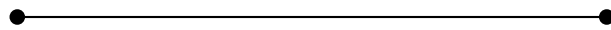
This session addressed the question of how can we provide educators with the latest methodologies and technologies for teaching STEM and astronomy.

Following are some of the points that were discussed:

- Science methods for education have to pass through Universal Design for Learning (UDL), Design Thinking (DT) and student centred approaches.

- Teachers need to be prepared to embrace this reality and assume the role of travel companion.
- It is important for astronomers to be perceived as experts in some scientific areas in order to be invited to have an impact in curriculum development and methodologies to be adopted in schools.
- Contemporary skills, 21st century skills are important to promote the learning of science content.
- Start with people that come to you for activities, to spread your influence further.
- Empowering teachers is important.
- Horizontal, vertical and diagonal articulation between curriculum subjects and grade levels is key for a more holistic approach in facilitating learning.
- Astronomy is by nature and inter/multi/trans-disciplinary topic.
- Liaise with existing organisations in the country that can support science education.
- You need to build a strong connection with teachers.
- Mindset of teachers have to change so they acknowledge that they do not know everything.
- Books can have wrong information and teachers need to feel comfortable in accepting that.
- Authoritarian attitudes are still common and have to be addressed continuously and carefully.
- It is important to use the good examples that are emerging and share it with other countries (for example, the Ireland curriculum for science).
- Teaching profession is very undervalued.
- Critical thinking is the key to change society in the future.
- The International Astronomical Union (IAU) should make a stand in sharing with ministries of education the power of trans-disciplinary nature of Astronomy to empower educators and build the necessary competencies in teachers and students alike. Astronomers have an obligation to use the power they have in their hands.
- Informal learning is also very important.
- How to bring innovative education to rural areas is also something that needs to be a priority and by all means trying to avoid enhancing the digital divide.

In conclusion, science education can be more fascinating and engaging with the provision of new teaching techniques and innovation. Collaboration is indeed necessary to make this innovation a reality and to make the teaching community of science education interesting. Teachers should embrace the available resources and organisations must somehow provide the necessary support to empower the science education community. Effective teaching methods are essential for making learning a more enjoyable experience. Adopting new strategies and dynamically altering them in response to student response makes the learning experience more engaging and efficient. Thus, science education will have a more encouraging vision for teachers and students for the betterment of the learning process of both.



Open source tools

Moderator: Santiago Vargas Dominguez (NAEC Colombia)
Support: Ndunge Roland (NOC Cameroon)

This session discussed the possible open source tools for communication and collaboration in astronomy outreach, education and elsewhere.

The discussion was centred on the idea of open source, that is the term used to describe an application, project, or tool that can be freely shared and modified by users. It started with the idea of source code, the base of software, being accessible and fed by others, but over the years the community evolved and is now-a-days considered to be more an “open source way”. Modern open source projects support principles and methods of collaboration for the open exchange of ideas, content, information, tools and, in general, community-oriented development processes.

In astronomy, there are many open source tools that are used by the community and that are fostering communication, education, outreach, and research. One of the most recognised is “Stellarium”, a free and open source planetarium, that has evolved and includes multiple options for amateur astronomers, teachers, students and passionate stargazers. In many places, it is a commonly used tool for mobile planetariums and has allowed to bring the wonders of the sky to children in remote places where the access to fixed facilities is limited. The IAU has promoted many open source resources, including software, activities, exhibitions, and collaborations, and loads of volunteering work has been crucial in order to maintain these important actions.

In the session, we also discussed the importance of open source tools in developing countries as, in some cases, their use represents the only way to access software, project, scientific content, etc. Many citizen science projects are using the same philosophy and have helped the incursion into astronomy for new participants at all levels. We can say that astronomy is very much an open science already but there should be more efforts to increase people’s involvement and support.

Open source tools encourage innovation through collaboration. The open source movement in astronomy has allowed many developments and from whichever perspective you look at,

it has contributed to improving technology and ideas, thus providing inclusive ways for many communities to close the gap of inequality. Sometimes people are familiar with commercial tools but not open source equivalents. We should therefore facilitate the use of open source tools and strengthen communities, spending time convincing and training them so that the ideas can be replicated to many others. Institutions and individuals should work together to create communities of practice in which the healthy open source ecosystems thrive. The IAU has an important role in promoting awareness and the importance of open source community-building.

Astronomy education in low-income communities

Moderator: Olayinka Fagbemi (NAEC Nigeria)
Support: Manuel Grullon (NOC Dominican Republic)

This session discussed ideas on how we can develop inclusive outreach for people in low income areas with kids who do not have access to basic infrastructure.

The theme is very important as much of our outreach resources cannot reach audiences with low-income. There are varied reasons for this – geographic isolation, aversion to strangers, lack of exposure to even the basics of what we present etc. It requires us to be very dedicated and understand the situation of the people we want to reach, which may vary from case to case. As an example, hunger is important and our colleagues in Kenya take food and solar electricity solutions with them for outreach in refugee camps. It is also important to keep our discourse fun and less technical. It is good to study the audience's own connection to astronomy or ask anyone from them to share their side.

Our colleagues in Argentina rightly pointed out that telescopes are very important when it comes to astronomy outreach, especially to those who have never looked through one. Our effort may be the only time they get to look through one and the effect can be life changing. However, many times the outreach colleagues themselves have a low income and thus they cannot afford a telescope. For example, individual educators in Tanzania, India etc. find it costly to spend 50\$ for a telescope (although schools/institutions should be able to afford that much easily).

Thus, astronomy communicators in low income areas are deprived of even telescopes and binoculars, which are seen as the tools of trade otherwise. To overcome this “scope barrier”, donation is often looked at as the best option. In many cases, this means a donation from outside the country. This in turn raises many issues like shipping, customs etc., which can become a costly affair.

Given that several successful designs are available for low-cost telescopes, our colleagues agree that donation of lenses/mirrors instead of the whole telescope may be a better way out. These are the costliest parts of a telescope and other parts can be put together even with plywood pieces or plumbing resources. A localised list of materials and guideline for putting all of these pieces into a telescope could be made. IAU could help a lot in this direction.

Other than telescopes, of course educators visiting remote/low exposure places could carry with them low cost sundials, sun projection setups, solar eclipse glasses, poster sets etc. Most of these can be made locally but the field colleagues are often not aware of them. There could be efforts to collate a list of such DIY resources. It would also help to have a set of posters or

info-graphics in all languages. These could be such that they can be effective even if the printing resources available are just black and white A4 sheet printers.

It is clear why the discussion dwelt mostly on awareness/outreach efforts and relevant requirements. However, we ended with suggesting that some of our colleagues, who can work with formal educators, also see if associating with an educational body would make things easier for them in low-income areas. There seemed to be ideas that overlap with the suggestions in the session about “Research in classrooms”. For example, targeting STEM teachers and connecting geography to astronomy were the unanimous suggestions.

In conclusion, donation of optics and awareness of amateur telescope making is the need of astronomy communicators reaching low-income areas. A repository of low-cost and adaptable, DIY resources and posters will enable them better. IAU could help with these.

Overcome gender inequality

Moderator: Sara Anjos

Support: Tshiamiso Makwela (NAEC South Africa)

The discussion topics covered were: Do the views of the various gender groups on astronomy and STEM differ? Can we use these views to inspire more children/teenagers with astronomy and help fill the gender gap?

We began by contextualising the session topic within the broader issue of diversity and inclusion. Diversity brings several benefits to organisations: less work withdrawal, less mental illness, more creativity and productivity, among others. There are several studies that demonstrate that, for instance, more innovative teams seem to link to ethnicity and diversity (Nathan, 2015), be more profitable (Hunt et al., 2018), and make best science (Adams, 2013; AlShebli et al., 2018). Talking about gender equality implies an inter-sectional and contextual approach of diversity and inclusion, with a focus on gender.

We thought we would divide the discussion into two parts, which correspond to two sides of the same coin: promoting gender differences before entering a scientific career and talking about the gender-related barriers that hinder success in academia for women.

Women and other under-represented groups still face both direct and indirect problems in their pursuit of a career in science, also in astronomy and space sciences. The fight for equity and inclusion in astronomy and more generally in science is highly complex and requires joint reflection. Numerous studies have found that women in STEM fields publish less, are paid less for their research and do not progress as far as men in their careers (Kewley, 2021). The pandemic has aggravated this situation.

Education is needed but it is not enough. There are societal challenges that heighten the gender gap in STEM. Being a societal problem, everyone should feel that this is an issue that concerns

them, seeking joint solutions to it. To make this topic present in the agendas, it was proposed that there should be a plenary at IAU meetings on this topic, so that everyone can be aware of the situation and jointly seek to contribute to the solution (even those who feel that this issue does not concern them).

It was suggested that the IAU should promote the presence of women in scientific organising committees, conferences and other scientific activities monitoring gender equality and highlighting the contribution to science that women make. There should be more part-time positions offered (especially for women who may be starting families) and paid labour to staff/students/postdocs working on issues of transformation. The IAU should also consider looking at equity when hiring as well as in recruiting volunteers in the offices.

Ideas have also emerged to promote awards and incentives for organisations that adopt concrete measures supporting the work of women scientists (similar to The Pleiades Awards in Australia or the UK Athena Swan).

Gender inequity issues are an inter-sectional issue, not just an academic one, as cultures and backgrounds have an influence on this. One of the things that need to be actively done is to focus on girls/women getting into STEM careers (scholarships and bursaries are currently available and there should be more for developing countries) and also focus on addressing the behavioural attitudes of boys/men. As an educational tool, astronomy has proven to be a powerful area to attract younger people into science and there are ongoing projects that are actively contributing to this goal.

Here are some interesting links that were shared during the discussion:

<https://ras.ac.uk/news-and-press/news/survey-finds-bullying-and-harassment-systemic-astronomy-and-geophysics>

<https://gender-gap-in-science.org/>

<https://www.iop.org/school-resources/address-gender-imbalance>

<https://www.iau.org/static/publications/springboard-booklet-150dpi-2page-view.pdf>

<https://asa-idea.org/>

<https://aic.sao.ac.za/>

<https://www.nature.com/articles/s41550-021-01341-z>

https://www.iau.org/public/themes/member_statistics/

Astronomy and careers

Moderator: Mayssa El Yazidi (NOC Tunisia)

Support: Sarah Abotis-Masters (NAEC Ghana)

The discussion centred around career opportunities for astronomy graduates in different regions and to advance the use of astronomy to facilitate STEM education and outreach, and promote productive employment opportunities.

In many parts of the world we are working to promote astronomy in various ways, including the promotion of more university astronomy courses. However, this can cause a problem since in some regions there are not enough openings in the astronomy sector for those with astronomy qualifications. It is recognised that many astronomy graduates go into careers not necessarily related to astronomy, whether by necessity or choice. However in other regions there is a different experience, some participants shared that in China and some Latin American countries there are not enough astronomy graduates to fill the vacancies!

We discussed the perceptions that people have about astronomy degrees. Astronomy can be perceived by many as a niche subject only for “dreamers” and somehow not related to the real world. Many people are not aware of what is involved in an astronomy degree, they don't realise that students learn valuable and transferable skills such as data analysis, critical thinking etc. We need to work to change this perception so that the advantages and positives of studying astronomy are recognised. The Basic Radio Astronomy training course from DARA (Development in Africa with Radio Astronomy) is a great example of an astronomy related course that includes some training on entrepreneurship so that students are equipped with broad and transferable skills. At the end of the course, students are encouraged to come up with business ideas to put their newfound skills to good use, and the best ideas receive some funding.

The discussion also touched on the need to encourage more women and girls to pursue astronomy. Globally, girls and young women still face a great many barriers if they wish to study science/astronomy/engineering. And although sometimes courses like the ISYA (International School for Young Astronomers) are oversubscribed for females, there are still difficulties as they attempt to enter the work-space. What can be done to help here? Participants agreed that it would be very useful to see examples of different career trajectories of astronomy graduates, and in fact some documentation of this type already exists:

- The RAS (Royal Astronomical Society, UK) has an online/downloadable booklet about “Careers and transferable skills in Astronomy and Geophysics”, that includes many case studies of those who went on to work in astronomy/space but also those who entered other sectors: <https://ras.ac.uk/education-and-careers/careers-booklet-sky-high-and-down-earth>.
- ISYA has just launched a survey to find out what their alumni are doing.
- DARA Big Data apparently also keeps a record of their alumni.

Conclusion and Outlook:

- More public education of what is entailed in an astronomy degree is required, so that its benefits are more widely recognised.
- More work needs to be done to encourage girls/young women to pursue studies in astronomy, and also to support them as they start their careers.
- Request that the IAU acts to collate information on astronomy careers, career paths and personal stories from diverse backgrounds/geographies so as to ensure global relevance.

Europe – Africa collaborations

Moderator: Nadeem Oozeer (NOC Mauritius)

Support: Mamadou N'Diaye

This session discussed possible collaborations between Europe and Africa in which astronomy can help improve societal and technological development.

The moderators and an invited speaker, Valerio Ribiero, presented an overview of some Europe-Africa (EuA) collaborations. The presented collaborations were: AERAP, DARA, AfAS, 5A, Doppler, and the Panafrican space science program.

The discussions topics were centred around what actions the IAU can take to facilitate the EuA interaction. We also discussed the lesson learned from previous EA collaborations, such as: what worked? What did not work? And how can we improve? We further investigated the expectation of collaborators in such initiatives, focusing on Outreach, Education and Development (SDGs). We explored various tools and funding mechanisms that are available to expand and enhance collaborations. Other discussion points were:

- Building solid relationships is critical for collaborations between Europe and Africa. There is a need to have continuous feedback and monitoring of projects. Furthermore, to enhance the partnerships, one has to understand the needs and local environment of participating countries. The participants agreed that building a roadmap is a crucial starting point before looking for collaborations. These roadmaps can be channelled through NOCs, NAEC, ROADs, AfAs, and OYA to disseminate the information rather than having many resources scattered around.
- One should also emphasise the training of secondary and primary learners to join higher education in astronomy and STEM. Such actions will allow a continuous fuelling of new generations in the field.
- Funding seems to be going to big projects rather than smaller projects. For example, on the African continent, the SKA appears to be tapping more attention. Hence, there is unequal development for other African countries. It is vital to identify alternative ways to get all the nations to benefit from EuA collaborations.
- One should also investigate bi-laterals between their country and other European countries and vice-versa to tap funding opportunities and other resources.

To conclude, the participants agreed that the IAU could be the point of contact for collecting and disseminating information about Europe-Africa collaborations through its offices. We carried out a small survey (<https://forms.gle/Wceyk2NH7hTx8FjG6>) to understand the Europe-Africa collaborations experiences and expectations, and the results can be made available on request.

Astronomy education and outreach in the Caribbean

Moderator: Yasmin Catricheo
Support: Carmen Pantoja (NOC USA)

This session was an opportunity for the IAU Office Family members from the Caribbean and those who want to collaborate to meet and discuss a set of topics of common interest.

Initially some background of the islands was presented. A list of questions were made available to guide the discussion. The total population of the Caribbean is 43,721,039 (est. 2018) and this is distributed over 34 islands. 14 islands with Independent Sovereignty, of those, 4 have NOCs and 1 NAEC. The remaining 20 islands: the Netherlands 6, France 4, USA 2, United Kingdom 5, Colombia 1, and Venezuela 2. This was followed with the introduction from participants and a discussion of the situation from some of the representatives of the islands. Following suggestions were made:

- Since some islands are independent nations and others are territories it would be useful that all islands have NOCs and NAECs to work at their locations. The territories will benefit from this and it will make work and collaborations easier.
- Need to understand the best ways to work with the education systems on the different islands.
- It would be useful to know the situation of science museums, planetariums and other facilities in the different islands since they are good point of contacts for astronomy outreach and education.
- Coordinated events such as the Exoplanet Naming have served to facilitate contacting persons interested in astronomy in the Caribbean.
- It would be useful to know what type of interactions exists between the professional societies and the Caribbean.
- How do we get more connections and support? What collaborations can be made, and how do we learn what are the needs of the region?
- It is recommended that the Andean Regional Office and the North American Regional Office of Astronomy for Development should communicate to be aware of each others efforts in the Caribbean.
- Announcement of Latin American School for teachers: <https://planetariomedellin.org/aulabajolasestrellas2021>.

- Zero shadow day was announced: <https://astron-soc.in/outreach/activities/zero-shadow-day/>
- A listing of amateur groups in the Caribbean was started.
- It was agreed to continue discussions in a follow-up meeting.

Astrotourism

Moderator: Lundby Rekaa (NAEC Norway)
Support: Nicolas Vasquez

This session explored astronomy related areas to promote scientific culture and sustainable tourism as a tool for development. Historical astronomical sites, conservation of nature for observation (astrostays projects) were discussed.

Dark skies and historical sites contribute to astrotourism as an attraction for incoming guests. The communicator is the key factor for success in astrotourism. Training and products related to tourism are necessary, such as guides and maps. Astrotourism can have a positive impact on formal tourism, it supports the tourism industry as a whole. Nonetheless, it needs to be connected with communities and the local government. The audience is composed mainly of people looking for experiential tourism. Trails and landscape watching are activities in demand.

During the meeting, ongoing projects in Italy, Ireland and Ecuador were discussed. The IAU and OAD have astrotourism as one working flagship. The division C: Education, Outreach and Heritage works on the recognition of sites of astronomical interest. "Astronomy for development is about people, not the stars" shows the efforts of the office of Astronomy for Development to contribute to developmental challenges using tools from astronomy for the benefit of society. Astrostays projects are proposed for their sustainability. Once the sanitary emergency caused by the worldwide pandemic is resolved, we expect a dramatic increase in the demand for tourism and leisure.

Resources for astrotourism:

<https://astrostays.com/>

<https://en.fundacionstarlight.org/>

<https://www.astro4dev.org/sustainable-local-socio-economic-development-through-astronomy/>

https://astro4dev.eu/images/main/Astrotourism_manual_ENG_150dpi.pdf

<https://www.skyatnightmagazine.com/advice/skills/stargazing-ireland-best-places/>

<https://www.youtube.com/watch?v=hcwv1g0j1to&t=6643s>

Telescope network

Moderator: Kuntal Misra (NAEC India)

Support: Sarita Vig (NAEC India)

During this session we focused on three agenda points:

1. Why do we need a network of small telescopes and what is the purpose of this network?

Local versus global network.

The people who attended the session were very positive about creating a network of telescopes. Such a network would reach out to a larger community to promote astronomical events (like covering an event for 24 hours, if feasible, using a global network). This would enhance (i) knowledge sharing, (ii) problem solving skills, (iii) helping with telescope handling and operations, along with (iv) interaction with the outreach community and the public. School students could perform small science projects using this network. However, whether such networks would be local (country based) or global (international) was a point of discussion. It was felt that the local network would be useful for countries that have sufficient critical mass in number of telescopes, while the global network could be very useful for countries that do not have many telescope resources.

2. How should such a network be created?

Modes of communication that can be used. There are several modes by which communication could be carried out amongst the different groups who are willing to be a part of the telescope network. WhatsApp, email, online forums, social media, and online discussions were some modes of communication that were favoured.

3. Possible outcomes:

- a) Research in classrooms and outreach activities
- b) Astronomical events

It was felt during the panel discussion that such a network would be very useful for astronomy outreach programmes, especially as some events could be covered for 24 hours without any interruption, while others could be streamed for places that cannot view the events. Events could be broadcast using Astronomy Outreach Telegrams. Teachers and students training will be an integral part of this network to maintain/operate the telescope along with small science projects like study of variability in stars and monitoring bright supernovae. To initiate creation of this network, an email could be circulated (with help from IAU) to all NAECs with a google form to gauge the number of people/countries willing to contribute resources to the small telescopes network. Community gathering and social interaction will enable for a better understanding and usage of this network.

During the summary session, it was pointed out that the small telescopes network could be actively tied to the theme “taking astronomy research to classrooms” which will result in a positive interaction between the two groups.

Education and outreach

Moderator: Premana W. Premadi (NAEC Indonesia)

Support: Dr. Zhu Jin (NOC & NAEC China Nanjing)

The IAU Office Family should be seen as the direct link between the IAU community and people worldwide, specifically through education. Therefore, we consider that it is necessary to give a clear theoretical definition of what is understood by education, by learning, by teaching, by formal, non-formal and informal areas, evaluation, qualitative and quantitative research. Besides, the differences between the concepts of education and dissemination/outreach must be clarified in order to reinforce the development of specific astronomy education research projects, different from those dedicated to outreach.

Audience: 20 people; Active participants: 6 + 2 (hosts).

Regions (and conditions) represented by active participants: Central America, Southern Africa, Central West Africa, Middle East, East Asia, Southeast Asia.

Issues and Responses:

1. Education and Outreach: what, who, how?

- Formal education: astronomy is still not included in general curriculum in majority of schools and regions; teachers appreciate help; at university level astronomy is quite exclusive to astronomy programs only
- Informal education: outreach, popularisation: routine as outreach program of observatories, university astronomy students, planetaria, science/discovery museum, less routine by amateur astronomer clubs, independent science/astronomy communicators; programs vary in activity, content, scheduling: very much dependent of resources: human, financial, facility, collaboration with schools, universities, institutions.

Astronomy needs to be recognised as part of basic science just as biology, physics, and chemistry in order it gets fair proportion in curriculum. Teachers and science communicators get better preparation for it, and learning resources improve in quality and quantity.

2. Content and delivery: variations: sky observation with minimal to optimal scientific explanation; school visits (in line with curriculum and/or extracurricular activities) which open opportunities to develop material together; more resourceful program can have more specific objectives, e.g., categorised content and delivery into cognitive levels; all try to be inclusive to variety of backgrounds and needs; experience in outreach activities offer a lot to improve educational methods in general.
3. Challenges and solutions: limitation, boundaries, support, network, sustainability: needs always outnumber resources; study materials and online resources are often not in native language; the use of mathematics as a more universal logic often helps; astronomy Olympiads (and other similar competitions) help promotes astronomy albeit limited to

excellent students and schools; light pollution is a hindrance in big cities where schools are of better quality: could push dark sky protection campaign via public night sky observation; some developing countries benefit from past and/or ongoing scientific collaboration with advanced countries to also take care of education and outreach in astronomy.

4. Aspiration and preparations: goals, evaluation, quality and quantity, training, recognition: provide good quality learning experience; international astronomy network helps with 'standard' quality as well as access to resources and support to upgrading efforts; the large gap between the advancement of astronomy as science and public understanding of astronomy, even in advanced countries, indicates the need for better and more rigorous outreach program and better cooperation among scientists, science communicators, trainers, facilitators, amateur astronomers, and all relevant institutions. IAU has been very good at recognising and supporting effort in education and outreach in astronomy such that more people are interested to contribute, and more work is developing for this cause.

Astronomical societies

Moderator: William Waller (NAEC USA)

Support: Sona Ehlerova (NAEC & NOC Czech Republic)

In this session participants discussed what (inter)national astronomical societies are already doing to support education and public outreach (E&PO) and how our IAU Offices could help these societies improve their E&PO efforts. Participants were asked:

- How well are your astronomical societies reaching out to the public?
- How well are your societies supporting elementary and secondary school students?
- How well are your societies supporting elementary and secondary school teachers?
- What sort of collaborative efforts among your societies could help advance their E&PO?
- What could the IAU Offices Family do to advance E&PO efforts by these societies?

We intended to follow a sequential format based on continents, where panellists from each continent would be invited to talk in the following order: Asia, Africa and the Middle East, Europe, North America, and Latin America. We ended up getting around 20 participants, with about 6 volunteers discussing their respective regions in a rather asynchronous manner. All continents but Latin America were represented in these discussions. Many of the panellists noted two kinds of astronomical societies. There are the astronomical societies that mostly serve professional astronomers and advanced students preparing to become astronomers. Other societies mostly serve amateur astronomers who, in turn, provide the bulk of the public outreach. Pre-collegiate

students and teachers are irregularly served by both kinds of societies, as there is often little to no systemic incorporation of formal astronomy education within the schools themselves. Polling of the participants indicated that their societies serve teachers well (25%), a little bit (67%), or not at all (8%).

Recommendations for the IAU Offices included:

- Establishing liaisons to the more influential societies (see <https://www.dropbox.com/s/u8tw8sdr86g5rnk/Listing%20of%20Astronomical%20Societies%20in%20E%26P0.pdf?dl=0>).
- Partnering with Astronomers without Borders (AWB, <https://www.astronomerswithoutborders.org/home>)
- Developing and promoting a formal curriculum in Astronomy for primary and secondary schools.
- Helping to provide teacher training in Astronomy (in-person, online, and hybrid).
- Re-examining any surveys that were administered by the IAU about the status of Astronomy in every country after IYA2009.
- Offering materials and technical support through the astronomical societies, as was done with recent eclipses.
- Providing a roster of people to give online talks (see <https://www.iau.org/public/meettheiauastronomers/>)

Office of Astronomy for Development

Kevin Govender, Director, OAD, South Africa

About the OAD:

The Office of Astronomy for Development (OAD) is a joint project of the International Astronomical Union (IAU) and the South African National Research Foundation (NRF) with the support of the Department of Science and Innovation (DSI). The mission of the OAD is to help further the use of astronomy, including its practitioners, skills and infrastructures, as a tool for development by mobilising the human and financial resources necessary in order to realise the field's scientific, technological and cultural benefits to society. This is primarily implemented through funding and coordinating projects that use Astronomy as a tool to address issues related to sustainable development. Since 2013, more than 200 projects have been funded through the annual Call for Proposals. The OAD has 11 Regional Offices and Language Centres around the world who share the OAD vision but focus their activities within a geographic or cultural or language region.

Reaction to the Family Meeting:

The first gathering of the various communities connected to the IAU Offices (our global “family”) proved to be a resounding success, in large part due to the excellent team at the OAE who coordinated the logistics of the event. In retrospect, it is understandable that this turned out to be a successful event, because when you bring together such a group of inspired, capable individuals, all connected through astronomy, magic is bound to happen!

I personally attended all or part of a number of sessions including Research in classrooms; Decolonising astronomy outreach and education; Citizen Science; Astronomy in insecure areas; Astrotourism; and several regional sessions (Oceania, French, Africa, Arab, EU-Africa). What I found most interesting from the OAD perspective is how many challenges are shared among the various IAU Office networks – with several topics having come before in discussions with the various OAD regional offices and language centres. Whether one is engaging in public outreach, education at school/university level, or looking at addressing development issues with astronomy, there are common obstacles that need to be addressed. By working together across IAU offices, we are able to overcome those obstacles easier. For example, if the OAD had a project in an “insecure area” then we could consult with the OAE and OAO about experiences in the region and possibly combine efforts/contacts such that our respective mandates are better fulfilled at that location. Similarly, there are also several resources available within the broader family of collaborators which can benefit the objectives of the different IAU Offices. For example, citizen science can be used to engage the public, stimulate education at school level, as well as potentially engage students at university level in terms of skills development. The same applies with regard to the use of robotic telescopes or data archives. The success of this meeting was in identifying those potential synergies and actually having real time discussions about how to

collaborate around them. The collection of brief session summaries is a great resource that can be used as a reference and starting point to dive deeper into particular topics.

Beyond the practical synergies and benefits that have arisen from the IAU Offices Family Meeting, there was something far more striking that emerged. What was expressed in those sessions, often without even trying, was the passion that people had in doing what they were doing. Their infinite kindness and caring for the world. Their sheer capacity to love, and to help, their fellow human beings. It was an amazing gathering of diverse minds but shared heart! Being part of this meeting brought into sharp focus the energy, the passion, the enthusiasm of our community towards a common cause – to make the world a better place through astronomy. To have such unity in a (virtual) room full of diverse people – from different cultures, locations, languages, backgrounds – is something that all participants should be really proud of.

It is within this diversity that lies our greatest strength. At the OAD the guiding principle of humility is written into our founding (and current) documents. It expresses the idea that we cannot possibly understand what is best for the people we hope to serve, without first actually listening and engaging. Ideas that may work in one environment may be irrelevant in another. Fundamental to abiding by this principle is acknowledging and respecting the importance and strength of diversity in all we do. In South Africa, home to the OAD, the national motto is *!ke e: /xarra //ke*, written in the Khoisan language of the /Xam people. It literally means *diverse people unite*. This meeting was a demonstration of this statement on a global scale.

And so I reiterate my thank you to everyone in this IAU family for coming together, for bringing your diverse views, your passion, your energy, and for uniting through our individual efforts, to use astronomy, in so many different ways, to ultimately try to achieve a better world for all.

Office for Astronomy Outreach

Lina Canas (IAU/NAOJ), Director, OAO, Tokyo, Japan

Overview of the IAU Office for Astronomy Outreach

The work of the IAU Office for Astronomy Outreach (OAO) is about building bridges between the IAU and the global astronomy community of amateur astronomers, outreach practitioners, educators, communicators, and the public, and through international collaboration, to make the science of astronomy accessible to all. The OAO team is based in Tokyo and the office is a joint venture of the International Astronomical Union (IAU) and the National Astronomical Observatory of Japan (NAOJ), under the auspices of the National Institutes of Natural Sciences (NINS) of Japan.

The mission of the OAO is to engage the public in astronomy through access to astronomical information and communication of the science of astronomy. Our mission is carried through a

network of IAU National Outreach Coordinators (NOCs) and implemented through the IAU's engagement initiatives with the public.

The role of the global astronomy community is essential to the successful implementation of the office key strategic actions under the IAU Strategic Plan 2020-2030 that include to:

- facilitate international communication through exchanges and translations;
- provide open databases and public-friendly access to astronomical information;
- encourage communication of science and critical thinking through IAU member public engagement, professional-amateur, and citizen science activities; and
- promote dark skies and the pale blue dot message.

All this accomplished by a knowledgeable, representative, and inclusive community of NOCs.

A global family with aligned goals

Across all discussions brought to the IAU Offices Family Meeting (OFM 2021) by our offices' representatives, we were most impressed to see areas that we, as IAU Offices, converge are already being discussed and tackled in a constructive and collaborative framework by NOCs, NAECs, ROADS and LOADs.

From our latest data, we have 24 NOCs that are also NAECs, 14 NOCs that are part of a ROAD or a LOAD and 15 ISYAs alumni that are NOCs. Therefore, it was natural to see (1) so many NAECs also committed to outreach, informal education, and communication. Actively moving beyond the formal education setting or reach and effectively involving the public, parents, and their community at large. (2) Many ISYAs members are active NOCs, with communication and public engagement playing an important role in their research careers and to whose, programs such as the IAU-Kavli Public Engagement Training program can contribute further to the training of these young professional astronomers in science communication and outreach. And, of course, (3) our colleagues in the ROADS and LOADs, focusing their work on astronomy outreach for development. Their outreach actions with a central component on socio-economic impact, such as astrotourism with an emphasis on dark and quiet skies protection and pale blue dot through global citizenship awareness.

A framework of action for the next triennium

Throughout the meeting, the OAO learnt and listen: from our community's own contexts and needs, to bring all that information into our planning and how that will shape and inform the OAO programs mid- and long term. How to improve the OAO impact and support to the inspiring work our offices representatives are doing in alignment with our mission.

The importance of representation: altogether with the NOCs improve representation within the network in some large countries and territories, identifying people already working on our converging topics (such as formal education with and for society, outreach for development). Work closer with the IAU National Committee of Astronomy (in IAU member countries) and the

NAECs, LOADs and ROADs and ISYAs Alumni to increase this national expansion in the NOCs representation.

One NOC is not representative of the entire country; therefore, it is paramount to demonopolising outreach representation making it more diverse and inclusive at a national level. The OAO has already established NOC Committees as large as ten to fifteen representatives from astronomy institutions and associations amateurs, professionals, science centres, planetariums; and it is important to understand how this model works in some countries and tailor it and expand it to each country or territory to help this representation, naturally including gender balance and underrepresented communities.

Outreach of the IAU within our networks: the OAO has the role of raising awareness of the work the various IAU Divisions, Commissions and Working Groups are carrying. We identified multiple discussion sessions during the IAU OFM 2021 that would mutually benefit with exchanges of expertise by bringing together our IAU communities - IAU members and the IAU offices family.

On evaluation and monitoring impact: building up and sharing existing tools and resources available for monitoring and evaluation. Provide guidance packages and training for public engagement initiatives, informal education and outreach.

On relations with amateur astronomers: highlight the best practices of so many amateurs already collaborating as our NOC representatives, bridging with (and between) amateur societies, organising Pro-Am international meetings.

- *On translations and language base-collaborations and exchanges:* strengthen our efforts with the NAECs, and the work they are doing. Utilise the volunteer network platform from the OAD to find more translators.
- *On recognising outreach actions by professional astronomers:* move beyond raising awareness of the importance of giving proper credit to the work of astronomers for their outreach activities and have it formally recognised and valued in their curricula by the IAU, employment institutions, etc;
- *Improve regional connections and collaborations:* support meetings and other actions across the various representatives in the same region.
- *Funding opportunities and community needs on funding:* create a list of international fundraising sources to be used across all office representatives, and to provide some training on how to apply. Funding for outreach efforts is most scarce and uncertain and make its sustainability long term difficult.
- *Accessible resources & tools:* Astronomy Awareness Kit, Open-source tools, identify STEAM tools, activities and resources, provide access to more resources including localisation, translations and overall re-design resources for a better representation.

Final remarks

Our community has identified a large and diverse variety of items, important across all offices, that we can actively and immediately address in the programs and projects of the OAO.

Independent of the topic, collaborations and support were transversal to all discussions as we are all contributing to the same mission – the mission of the IAU of promoting and safeguarding the science of astronomy through international cooperation across research, development, education, and communication. This is our mission; this is what brings us together: each of the offices with a particular goal, a well-defined set of strategic actions to implement in the next decade but united in the same mission as we are all IAU.

It was clear we found in our community a place where we can share our concerns, anxieties, struggles and that we have a safe space. Building a community of support and dialogue is essential, a group we know we can turn to, lean on and rely upon. Sharing the same values, the same goals, the same excitement for astronomy, and how to make a positive change in society, altogether with the family we choose.

To all our extended family and friends, our heartfelt thank you very much on behalf of the IAU Office for Astronomy Outreach. Let this meeting be a promising beginning and the first of many. We at the OAO wish you all had an inspiring and fruitful meeting. It certainly was for us.

Office of Astronomy for Education

Carolin Liefke, Deputy Director, OAE, Heidelberg, Germany

The IAU Office of Astronomy for Education

The mission of the IAU Office of Astronomy for Education (OAE) is to support the community of professional astronomers and astronomy educators worldwide to use astronomy as a stimulus for STEM teaching and education from elementary to high school level. The OAE is hosted at Haus der Astronomie in Heidelberg, Germany, and is a joint project of the International Astronomical Union (IAU) and the Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG), represented by the Max Planck Institute for Astronomy. It was founded in December 2019 and is co-funded by the Klaus Tschira Foundation and the Carl Zeiss Foundation.

The OAE is dedicated to working in close collaboration with the astronomy education community worldwide. Its activities aim at supporting teachers, educators and astronomers interested in education, at providing astronomy education resources, and at promoting astronomy in school curricula.

The availability of resources (ideally in local languages) is crucial for astronomy education. Since not reinventing the wheel is one of our core principles, taking stock of existing materials and their

dissemination is important. The OAE itself, with the help of the astronomy education community, also provides infrastructure, e.g. the astroEDU platform of peer-reviewed educational materials, and creates and curates fundamental astronomy education resources, like a glossary of essential astronomical terms for primary and secondary school education, as well as astronomical images, illustrations and animations that are free to use. Additionally, the OAE pushes the translation of resources.

The OAE Reviews, compact summaries on a given topic based on existing resources and developed by experts in the field in a living document will help astronomers interested in education to keep up with astronomy education research developments, modern teaching methods, and evaluation techniques, and educators with astronomy-specific topics.

OAE Schools for Astronomy Education (SAEs), to be established locally and online, will foster the professionalisation of teachers. Defining community standards will ensure reputation and quality of resources and training.

The OAE as a part of the IAU offices family

The OAE is the youngest of the four IAU offices, and thus we were able to benefit from the existing structures of the other offices from the very beginning. Our own network of National Astronomy Education Coordinator (NAEC) teams is based on the concept of the National Outreach Coordinators (NOCs) of the Office of Astronomy Outreach (OAO). The NOCs, together with the Regional Offices and Language Centres (ROADs and LOADs) of the Office of Astronomy for Development (OAD) and their country coordinators helped us to identify and vet potential candidates for the NAEC teams; and many NOCs additionally joined the NAEC force themselves.

Key members of the astronomy education community in many countries have ties to the IAU that date back for decades – as alumni of the International Schools for Young Astronomers (ISYAs), now organised by the Office for Young Astronomers (OYA). This includes staff from the OAE Centers and Nodes that have already been established or are in the process of establishment in different countries around the world to support the mission of the OAE with additional resources.

Prior to the existence of the OAE, astronomy education in primary and secondary schools has been supported by both the OAD and the OAO, and both offices will continue to do so. Considering the continuous transition between astronomy education and outreach as well as the crucial role played by education in development actions, there is a significant overlap in the missions of these three offices, and the immediate conclusion is to work as closely together as possible. For us, this has been a very helpful and pleasant experience, and I would like to thank my colleagues at the other offices for the fruitful collaboration.

The Offices Family Meeting

The initial idea to bring the NOCs of the OAO and the NAECs of the OAE from different countries together to foster collaborations between them quickly evolved into something bigger that included the networks of all four offices. This is how the Offices Family Meeting was born. The intention was to strengthen the existing networks, and to initiate inter-offices collaborations between individuals. Thus we decided against a classical conference format with pre-defined

talks and issued a call to propose topics for sessions instead, with a strong focus on discussion and networking. This ensured that the session topics were actually close to the heart of the participants.

While not everything might have been perfect or as smooth as it could have been, the result was overwhelming: It was great to see so many people unified in their passion for astronomy, and for education and outreach. With everybody willing to join forces and share their knowledge, several initiatives and collaborations were launched or revitalised.

Above all, this emphasised that we – the offices family – are really a family: a community with strong ties. And yet, we'd like to welcome additional members, i.e. to recruit people from countries or territories that do not have representatives in the networks of the different offices yet, but also to motivate those people who are currently not actively participating. Let the Offices Family Meeting be a starting point: for knowledge exchange, for collaboration, and for growth.

Office of Young Astronomers

Itziar Aretxaga (INAOE, Mexico), Director, ISYA

The International School for Young Astronomers (ISYA) is a three-week long intensive graduate school that targets countries where astronomy is not fully developed, as well as isolated graduate students around the globe. It has organised 42 schools and enrolled 1484 alumni over its 54 year lifespan. The ISYA, funded in 1967, is the main program of the Office for Young Astronomers (OYA) since its creation in 2015. OYA is a virtual office funded by the IAU and the Norwegian Academy of Science and Letters to provide the support for ISYA. It does not have any permanent staff. ISYA director and deputy director, who are volunteers to the program, are the main contact for the initiative.

At the IAU Offices Family Meeting we had the opportunity to connect with the extended national networks of the other 3 IAU Offices. In preparation for this encounter, we looked at the presence of ISYA alumni in OAD/OAE/OAO networks to find 17 National Astronomy Education Coordinators (NAEC), 15 National Outreach Coordinators (NOCs) and 3 members of Regional Offices for Astronomy Development (ROADs) to be alumni of ISYAs.

The interaction with national contacts in the one-to-one space of the Offices Meeting was tremendously rich. We certainly met with pleasure our own alumni, but also new contacts that provided a diverse perspective for the ISYAs. We were reminded once again of the enormous impact pioneers have in their country of origin, and the line of transmission and passion to pursue graduate studies in astronomy that depends on these individuals that plant the seeds in their communities. Some representatives reminded us of the need to extend ISYA announcements through their own networks, as communications by IAU members sometimes do not reach nation-wide students. Announcements are sent by email to IAU national members in the

IAU region of interest for the school, and to contacts for OAD and OAO in countries without national or individual IAU members, as well as through the IAU social media. We will now send announcements through all IAU networks of the region of interest.

Interactions in the discussion group of “Astronomy and careers” emphasised two aspects that are developed in our program too: the need to present career options outside of academia, and the need to present a list of skills that are particularly developed in an astronomy degree and later applied in non-academic jobs, to encourage students to join the field. Scarcity of jobs in academia is one of the reasons mentioned by representatives of countries with developed astronomical societies, and lack of national professionals, graduate schools, development trajectories and role models was mentioned by representatives of countries with small or no professional astronomical communities. On the other hand, representatives of countries with sizeable professional astronomical communities (>100 IAU members), but still relatively small for their population, stress the scarcity of young researchers that can develop the science and fill available positions in research centers and universities. Mobility is, in this case, a disposition that needs to be emphasised. A document developed by the Royal Astronomical Society of the UK was mentioned in this session, and this provides a good model to present careers outside of academia, but it needs to be adapted to the different IAU regions.

OYA has implemented through its history a series of workshops aimed to enhance the career development options of ISYA students. We have a perspective to contribute with, as these are aspects we discuss in our workshops. Career paths outside of research in academia are indeed presented within ISYAs and we note that a significant percentage of the students attending are eager to complete their degrees with the aim to apply their skills outside of the well-known academic path of research, whether this is outreach, education or policy making. Often they do not find role models to do this transition or they feel stigmatised for having different goals than the majority of their peers. The discussion on career options reassures them that their goals are valid ones within the astronomy community at large. More discussion and training is needed in universities to recognise and thrive in this diversity of goals among our youngsters.

In the discussion group of “Astronomy in insecure areas”, we had some input to share, as our very heterogeneous groups of alumni face different perceptions on security when visiting a foreign country, often for the first time. Security measures need to be checked upon and communicated by the local organising teams from the perspective of a person foreign to the traditions and uses in their communities.

The IAU Offices Family Meeting was a delight to participate in, and a good exchange of points of view, values and visions from around the globe for the field of astronomy.