

NAEC DIALOGUE Preliminary Report



The IAU Office of Astronomy for Education (OAE) National Astronomy Education Coordinator (NAEC) dialogues were semi-formal interviews with the community of NAECs that were established since the commencement of the OAE. The NAEC dialogues aimed to gauge what NAEC activities are in line with the OAE goals as well as to check in on the NAECs, see where we can support them and how we can support them.

To date, the OAE has confirmed NAECs in 123 countries and has over 400 NAECs in total. This is 400+ people pioneering astronomy education in their respective countries and regions. This community has been seen as one of the successes of the OAE since its inception in 2020. However, due to the limited staff members at the OAE, time constraints, and unavailability of the NAECs, we have only completed a 3rd of the NAEC dialogues with 41 countries and 93 NAECs present at the dialogues.

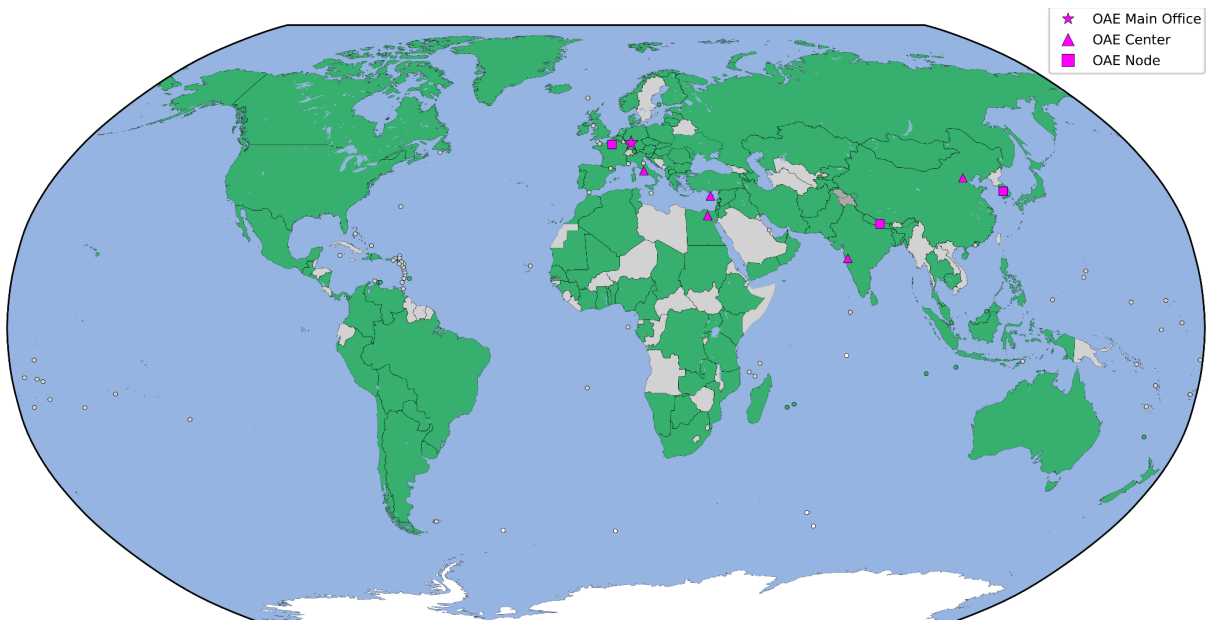


Fig. 1 NAEC Map

The interviews/dialogues took place online via Zoom, each about an hour long. There were at least one or two members from the OAE staff as the hosts and the NAEC team of a certain country (In some cases we had a full team while in others we had 1 or 2 representatives). The meetings were recorded for NAECs who were comfortable with the recording and notes were taken during the interviews. A full summary of the dialogue was then written and provided by the hosts of the meeting and a verbal summary was shared with the team during the weekly OAE team meetings.

We have analysed the summaries provided by the hosts of the dialogues, which are snapshots of the actual meaning. We acknowledge that there may be some biases or lack of reporting in some instances, but this information is helpful for the OAE to know which areas they need to strengthen their NAEC support. The analysis used a deductive thematic method, where there were pre-identified categories, into which the key ideas from NAECs' responses were grouped. We had questions which are aligned with the objectives of the OAE, including but not limited to; (i) The professionalisation of astronomy, (ii) Providing access to good resources, (iii) Promoting astronomy in the curriculum, (iv) Maintaining a network of supporters, & (v) Spreading the news.

In the following paragraphs, we will be highlighting the findings from these summaries, which include key aspects relating to; (1) the NAECs, (2) the network of supporters, (3) the professionalisation of astronomy, (4) astronomy in the curriculum, (5) access to astronomy resources, (6) spreading the news and (7) other lessons learnt. The description of these categories can be found on the OAE website, as they are closely related to the OAE objectives.

1. The National Astronomy Education Coordinators (NAECs):

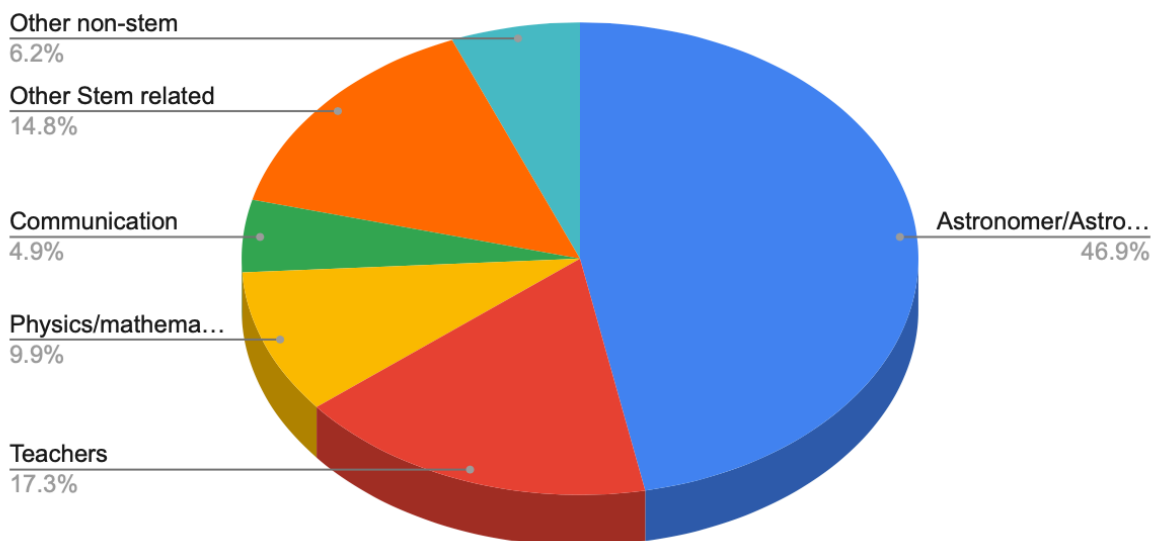


Fig. 2

Getting to know who our NAECs are, was captured well in the dialogues, as NAECs professions and interests were mentioned and then separated from each other for the analysis. Many of our NAECs are appointed based on their involvement with astronomy education, astronomy in

schools, and astronomy with children and outreach in some cases. However, the NAECs come from distinct professional backgrounds. As shown in Fig 2, 49% of our NAECs are professional astronomers, mainly with positions at institutions of higher education (universities), these make up the larger group, followed by the school teachers at 17%, who are actively teaching at schools as well as those who are retired. We also have 14% of astronomy education practitioners, such as the planetarium and science museum personnel, who interact with school groups or teachers on a day-to-day basis at their organisations. The “other-none-astronomy” group includes a variety of professions, such as engineers, geologists, and science communicators.

The wide range of expertise seen within this community shows that astronomy is certainly a common interest, including astronomy education and astronomy outreach. The recorded interests in Astronomy Education are in the following aspects: developing astronomy in the curriculum, running astronomy olympiads, using astronomy to promote STEM subjects and also introducing astronomy at the university level. It is worth noting that very few of the NAEC are doing astronomy as a hobby.

The NAECs were also asked about their involvement with Astronomy Education Research, (AER) which many of the NAECs reported that they were unfamiliar with, hence they are not involved with any active Astronomy Education Research in their practices. Within the majority that has shown no experience in AER, a small subset of them are interested in learning and developing some aspects of AER that they can use to measure astronomy knowledge and the impact of their work.

In cases where the NAECs have experience with Astronomy Education Research (AER), they have conducted research previously and continue to do so as part of their general interests. Individuals with AER experience are now interested in addressing knowledge gaps in areas such as indigenous astronomy knowledge. Some NAECs have students pursuing Master's degrees and PhDs in AER, and they are well aware of the challenges that exist in the field. In places like Canada and the Netherlands, NAECs possess extensive experience with AER and are willing to engage with other NAECs on projects of mutual interest.

2. Network of supporters

With regards to the network of supporters, the main question discussed was “What kind of collaborations exist within your country or region?”, the answers to this question were analysed and divided into three parts, namely: current efforts that are carried out, what potential improvements that need to be made, and communication (with their networks, with the OAE and with the wider NAEC community).

Current efforts:

In many countries, the NAECs are doing projects with multiple organisations and with different people (teachers, communities, school children). From the analysis, we found that a lot of connections are linked to universities and university students, which aligns with (point 1) as many of the NAECs are based at universities and institutions of higher education. Another popular organisation was the astronomy clubs, which comprised at least a 3rd of the data, followed by school teachers. Astronomy clubs exist mostly as an out-of-school/ extracurricular activities, which is not necessarily part of the schooling system.

Some NAECs mentioned the existing collaboration that they have with NAECs of other countries, such as in the case of Ghana and Mauritius, who have collaborated on a project with students that are visually impaired, the two teams have since continued with this collaboration and implementing some teacher training aspects to it. This is positive as it shows interest in the sharing of knowledge and resources within the network.

The NAECs around the Mediterranean region have built connections due to the activities spearheaded by the OAE Centre Italy. Through the STEAM-ed and codesign schools, the I-OAE has successfully brought the nAECs around the region together, to build, create, design activities which each could run at their own institution and countries. This collaboration fosters relationships that transcends beyond borders, as each comes with the goal of bringing about a meaningful contribution to the community. The NAECs that have taken part in these schools, have noted this as one of the great projects.

Potential Improvements:

A lot of NAECs have mentioned that a lot of work still needs to be done regarding building a sustainable teacher network, where they can have teachers to closely work with in developing astronomy materials. The noted difficulty in building teacher networks mostly lie with the time constraint, astronomy not being in the curriculum, and the teachers are overwhelmed with their duties. In the the USA, teachers are to be compensated for any activity that happens outside the allocated teaching duties. Another difficulty is the relationship between the NAEC and their ministries, which is not always straightforward.

The NAECs are also actively working on building relationships with observatories and planetariums in their countries. Another key interest was that NAECs are willing to collaborate with other NAECs within their specific regions, this is good for the OAE, especially for community building.

Communication:

The OAE sends communication via the mailing list on clever reach, on the OAE website via news items, on basecamp and social media (Facebook and Twitter - X). The NAECs have no issue with how the communication is shared via emails and social media, but many had strong feelings concerning Basecamp. The NAECs mentioned that they do not find Basecamp an effective tool for them to use and engage with, some of their reasons involve the platform being complicated, difficulty in following messages, and difficulty in orientating themselves on the platform. The consensus is that some NAECs completely hate the platform (many of them). The small margin that has use basecamp, are those with experiences as NOCs, who have used the platform for longer and are happy with the platform. In addition to the strong feelings shared, some have suggested another platform such as Slack.

Furthermore, communication also includes the NAEC quarterly meetings, which we (OAE) host each quarter to update the NAEC on the initiatives and activities of the OAE, such as the call for TTP, the Shaw workshops, Glossary updates or other updates from the Centres and Nodes. During the NAEC quarterly meetings, we also ask for contributions from the NAECs, where they can share their current work or projects that they are carrying out in their countries. The NAECs stated that they are aware of the quarterly meetings, but due to many time constraints, they do not attend the meetings. In one case, a NAEC said “I have not attended the meetings and I prefer meetings that are more focused like this one”. This correlates directly to what we have observed, the quarterly meetings are not well attended at all, with an average of about 50 or fewer NAECs attending the meeting (for all time zones).

The NAECs are happy and comfortable with the OAE news shared on Facebook and Twitter, saying that they are updated in that way. However, in one dialogue they mentioned the need for the OAE to be a bit more proactive as the OAO, and think about something like a newsletter to share the updates, and requests with the NAEC community, perhaps in addition to the quarterly meetings.

3. Professionalise astronomy education

The professionalisation of astronomy education is an objective of the office, it was important to find out how our NAECs are doing this in their capacity. When analysing the responses related to the professionalisation of astronomy, the question framed were “In what ways can astronomy be professionalised?”, as such we had three themes in which this was answered; (i) current practices that exist, (ii) future opportunities and efforts, and (iii) challenges faced.

Current Practices:

In terms of activities done within countries regarding professionalising astronomy, the NASE (Network for Astronomy School Education, Deustua et al., 2013) project dominated the responses, showing its significant contribution to astronomy at the school level. The NASE teacher trainings have contributed to promoting astronomy in many countries and thus it is a useful network for the NAECs to be part of. One of the key factor of the NASE is its transferability and translation into different languages, which makes it easy to adapt in a variety of situations. Apart from NASE, the different countries (at least more than half) have many teacher training programmes, some with other collaborators like the planetarium, ESA etc. It is worth noting that the countries with recorded teacher training, also have good relations with the local universities and planetariums.

Question	Category	Key Ideas
In what ways can astronomy be professionalised?	What is done?	NASE
		Local teacher training (by governments, NGOs and TTP)
		Astronomy clubs
		Active planetariums
		Developed a pedagogical tool for astronomy
		Textbook contributors
	What else can be done?	More TTP's
		Translation of materials
		Secure sustainable funding
		Use planetariums
	Challenges faced	Funding
		Availability of teachers
		Time
		Certification/accreditation
		Different educational systems
		No Astronomy in Higher Ed

Some NAECs mentioned that they are contributors or reviewers to locally approved science textbooks for schools, which is very important as there is a lot of misinformation and misconceptions that are in the textbooks. Very few of the NAECs have direct relationships with the Ministry of Education, which excludes them during textbook changes. However, when it comes to the curriculum discussions few of the NAECs are included by their ministries.

Future opportunities/efforts:

Teacher training is at the top of the suggested initiatives that need to be done in many developing countries, with some of the teacher training programmes being part of the OAE TTP model. More of the TTP's are seen as an opportunity to grow teachers' interest in astronomy (as there seems to be no interest in some regions, from teachers). In addition, some countries do not have astronomy in higher education (graduate level), therefore developments need to be made across the education board. Some NAECs have even suggested that the OAE assist them with developing an introductory astronomy module for the university level, however, higher education is not the mandate of the OAE, as the strategic goals of the IAU clearly states that the OAE is to promote the use of astronomy for teaching in school level .

Challenges

The challenges that exist in astronomy education have been recorded in AER, which include difficulty in content, lack of teaching resources, teachers' lack of knowledge and general attitudes around astronomy and science in communities. However, the challenges that are stated with NAECs have to do with the structure of the education system, i.e. it is challenging to professionalise astronomy when it is not included in the education system of the country. As such, in countries with no astronomy, the goal is to include it within the school curriculum, but with no interest from the teachers, it is problematic. The continuous changes in curriculum in different countries also poses a challenge, in which, astronomy content gets smaller and smaller with every curricula revision. In large countries, curricula are based on the different states, so the curriculum is not necessarily one size fits all in that country but the priorities of education differ.

Funding was also a key aspect of professionalising astronomy, however, there isn't enough of it. Many NAECs in developing countries have stated that the lack of funding is a barrier to executing effective measures for the growth of astronomy. The TTP funding is seen as a great input, although the funding is too little, (*The TTP's is a micro-funding, aimed at supporting small scale teacher training, to support countries to start developing capacity in astronomy education*). A suggest was made that maybe programmes need to run on a multiyear basis to have long-term sustainability and impact. This suggestion has been noted, but we (OAE) are constrained by the funding we receive from the IAU.

Other NAECs mention time constraints as another challenge, mentioning that talks with ministries can take a long time, which includes writing proposals and nothing comes out of it. A suggestion to the OAE was to offer a formal letter of appointment for NAECs to also use when going to the ministries.

4. Promoting astronomy in the curriculum

This point is closely linked to (3), the professionalisation of astronomy also includes promoting astronomy in the curriculum. There is a lot of overlap between 4 & 3, however, there are other challenges that are linked to the curriculum, that we noted here but not in 3.

The astronomy content that exists in some countries is usually minimal, in which astronomy is woven with other subjects such as physics or geography. As such, it is likely that some countries (i.e. Bangladesh), use the opportunity to promote astronomy along with the other STEM activities that the government endorses. Curricula across different countries are also said to be very dense, with little room to add anything new, as such in other countries, astronomy is introduced as an extra curriculum subject, and thus optional for both students and teachers. In a recently published study, that followed on the astronomy in curricula survey, showed that a lot of the practitioners (i.e. teachers) favoured informal, self-directed astronomy learning over mandated and formal curricula (Hirst Bernhardt & Bailey, 2024).

Q	Key Ideas
Curriculum challenges	No Astronomy in Higher Ed, PS & SS
	Teachers' confidence
	Time
	Dense curriculum
	No professional curriculum advisors
	No direct contact with ministries
	Lack of Indigenous Knowledge
	Astronomy as extra-curricular activity

Teachers' lack of confidence in astronomy is also a huge barrier to effective astronomy teaching. This is a challenge that projects like the OAE TTP are trying to mitigate. There is a general lack of physics teachers across the board, and most astronomy is taught by physics teachers, therefore, there is a need to argue for the need for astronomy programmes beyond primary and secondary schools.

Astronomy is also often too Westernised, with a lot of astronomy being introduced to people from a perspective they cannot fully relate to. The lack of astronomy indigenous knowledge in astronomy is also a recorded challenge, as one NAEC stated 'We need a curriculum that captures Indigenous knowledge so that the indigenous nations are not left behind'. We need to

find ways to include the indigenous knowledge and culture of astronomy, to draw on this knowledge in framing astronomy content, the learning and teaching.

5. Provide access to good resources

For this part, we sought to understand what kind of resources are available to the NAECs and their networks in their country (locally), and outside their countries, and whether they use any of the OAE resources and the challenges thereof;

Textbooks are a common resource that is available in many countries, however, as mentioned these tend to have a lot of outdated information, misconceptions and other common scientific errors. In addition to textbooks, some countries like Hong Kong, are more on the developed side, they have telescopes and Earth globes in every school.

There are some external resources used as well, such as NASA resources and lesson plans, which a lot of the NAECs seem to have used. Stellarium has also been noted as a commonly used external resource. The most used resources offered by the OAE are the AstroEDU activities, which most NAECs said they liked (although the language barrier is an issue).

Table summaries the emerging categories and key ideas from no 5.

Question	Category	Key Ideas
What resources do you have?	Local resources	Textbooks – Including university books
		Tablets
		Telescopes
		Hands-on tools
	External resources	NASA
		Stellarium
		AstroEDU
		Big Ideas
	Challenges	Funding
		Language barrier
		Internet

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In cases where resources are limited, NAECs have tried to form partnerships with teachers, especially those in rural/remote areas, by sending them materials. The teachers in the NAEC network have said that hands-on resources are most effective for their astronomy teaching and learning.

Language barriers significantly hinder access to astronomy resources, as most materials are available primarily in English. This creates difficulties for individuals who do not speak English, underscoring the need for resources to be translated or produced in local languages. Such translations would ensure that people can access suitable materials that cater to their linguistic needs.

Another major issue is the lack of reliable internet access. Many people rely on online resources available on websites and the internet. In rural areas, however, internet connectivity is often poor, preventing individuals from accessing the information they need. For instance, there was a case where information was shared with teachers in rural areas via the WhatsApp platform. This approach presented challenges, as it required explaining how to use the resources and clarify certain concepts over text, which proved to be quite time-consuming and inefficient. These barriers highlight the importance of developing offline and locally accessible educational resources to support effective learning and teaching in astronomy

6. Spreading the news:

In terms of spreading news, most of the NAECs primarily rely on social media platforms like Facebook and Twitter, as well as emails. These channels serve as their main avenues for disseminating information and keeping their communities informed. However, it is worth noting that while these platforms are effective for many, some NAECs have expressed dissatisfaction with Basecamp, finding it less suitable for their needs. Instead, they prefer the immediacy and accessibility of Facebook and Twitter for updates and announcements.

Moreover, there are instances where NAECs leverage more localized methods to reach their audience. For example, one NAEC contributes to a local newspaper by writing a STEM column, which is a valuable resource for keeping the community informed about the latest developments in science and technology. This approach not only helps in spreading news but also ensures

that information reaches a broader audience, including those who may not be active on social media.

These varied methods of news dissemination highlight the importance of using multiple platforms to cater to different preferences and ensure that important updates and information are accessible to all members of the community.

7. Other

Many of our NAECs are content with their roles within the OAE. They are well aware of the ongoing projects, such as the TTP. Some have successfully applied for and received grants, while others are considering applying in the future. Those with sufficient resources and funding have indicated that they will not be applying for the TTP. The OAE is working on developing the astronomy teacher training standards which can be followed by all who wish to organise teacher trainings, as a way to endorse such programmes outside the OAE TTP model.

The NAECs have suggested that the OAE host training sessions and workshops to help them address some of their challenges. Proposed workshop topics include:

- Reaching different stakeholders
- Writing grant proposals
- Various astronomy teaching strategies
- Conducting effective workshops
- Social media management
- Building a community

These workshops would not only provide support but also offer development opportunities for the NAECs. Additionally, they suggested that the OAE provide downloadable and printable "swag" items, such as stickers and pins, which they can use when running their projects.

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