

The background features a light blue gradient with several concentric dashed blue circles. Scattered throughout are small grey dots representing stars, a solid blue sphere, and a blue ringed planet. The central text is contained within a dark blue circle with a lighter blue border.

Proceedings for the
4th Shaw-IAU Workshop
on Astronomy for Education

**Leveraging the potential of
astronomy in formal education**

15 – 17 November, 2022



Compiled & Edited by:

Asmita Bhandare, Eduardo Penteadó, Rebecca Sanderson, Tshiamiso Makwela, Niall Deacon, Moupiya Maji, Emmanuel Rollinde, Francesca Cresta, and Aniket Sule.

The following is a collection of summaries from the 4th Shaw-IAU workshop on Astronomy for Education held 15 – 17 November, 2022 as a virtual event. The workshop was organised by the IAU Office of Astronomy for Education. More details can be found on: <https://astro4edu.org/shaw-iau/4th-shaw-iau-workshop/>.

The IAU Office of Astronomy for Education (OAE) 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 Klaus Tschira Stiftung and Carl-Zeiss-Stiftung. The Shaw-IAU Workshops on Astronomy for Education are funded by the Shaw Prize Foundation.

The OAE is supported by a growing network of OAE Centers and OAE Nodes, collaborating to lead global projects developed within the network. The OAE Centers and Nodes are: the OAE Center China–Nanjing, hosted by the Beijing Planetarium (BJP); the OAE Center Cyprus, hosted by Cyprus Space Exploration Organization (CSEO); the OAE Center Egypt, hosted by the National Research Institute of Astronomy and Geophysics (NRIAG); the OAE Center India, hosted by the Inter-University Centre for Astronomy and Astrophysics (IUCAA); the OAE Center Italy, hosted by the National Institute for Astrophysics (INAF); the OAE Node Republic of Korea, hosted by the Korean Astronomical Society (KAS); OAE Node France at CY Cergy Paris University hosted by CY Cergy Paris University; and the OAE Node Nepal, hosted by the Nepal Astronomical Society (NASO).



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4th Shaw-IAU Workshop on Astronomy for Education

What would you need to know to be able to strengthen the role of astronomy in schools? You might want to look at how curricula are created in the first place, and you will want to profit from the experiences of those who have already been successful in including astronomy in their countries' curricula. You would likely be interested in the various roles that astronomy can play in practice, in both primary and secondary schools. You might turn to astronomy education research for answers to questions about what fosters student interest in the STEM subjects science, technology, engineering and mathematics — and since at least part of the answer appears to be that cutting-edge results, such as those involving black hole shadows or exoplanets, are of particular interest to numerous students, you might want to look into including those topics in school teaching. Last but not least, you might look for synergies between astronomy and raising awareness for one of the most pressing challenges of our time: climate change.

That, at least, were our assumptions when we considered which sessions to include in this year's Shaw-IAU Workshop, and from the feedback received so far, we seem to have hit the mark. The workshop itself was truly global, with 600 participants from more than 90 countries. We particularly salute those participants who had to make special efforts to attend, circumventing state-imposed restrictions on international communication. With these proceedings, as well as the videos and posters from the workshop that are available online, we make the various contributions available beyond the confines of the workshop itself.

Although the total count is only up to four, the Shaw-IAU Workshops have already become something of an institution. Their genesis, of course, is directly linked to the International Astronomical Union's establishment of its Office of Astronomy for Education in late 2019, hosted at Haus der Astronomie and the Max Planck Institute for Astronomy in Heidelberg, Germany, and the evolution of the Shaw-IAU Workshops has paralleled the building of the OAE as a whole. The online format started out in 2020 as a pandemic necessity. But we soon realised that the kind of online meeting the Workshops provided was a highly accessible format that would allow us to make these workshops truly global, and to set the threshold for participation as low as possible. We acknowledge that there still *is* a threshold – since internet access with sufficient bandwidth is required – and we will continue to look for ways of increasing accessibility even further. Perhaps the hybrid format pioneered by the OAE Center China-Nanjing this year, which combined the virtual and international Shaw-IAU Workshop with an in-person teacher workshop (as well as a nation-wide online workshop) is a model for the future?

On the part of the Office of Astronomy for Education, we hope that these proceedings will help you to make better and more effective use of astronomy in support of primary and secondary school education. It's a big universe out there — let's encourage students to explore it!

Markus Pössel
Director, IAU Office of Astronomy for Education
Heidelberg, December 2022

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Organising Committees

Local Organising Committee:

Asmita Bhandare, Ankit Bhandari, Sigrid Brummer, Niall Deacon, Natalie Fischer, Esther Kolar, Anna Ladu, Tshiamiso Makwela, Carmen Müllerthann, Eduardo Penteadó, Markus Pössel, Bhavesh Rajpoot, Saeed Salimpour, Gwen Sanderson, Rebecca Sanderson, Anna Sippel, Tilen Zupan.

Scientific Advisory Committee:

Mohamad Alassiry, Ali Al-Edhari, Mashhoor Al-Wardat, Asmita Bhandare, Suresh Bhattarai, Estelle Blanquet, Silvia Casu, Ahmed Chaalan, Merryn Cole, Hassane Darhmaoui, Niall Deacon, Rosan Doran, Federica Duras, Livia Giacomini, Edward Gomez, Violette Impellizzeri, Jacob Tolno Israel, Li Jian, Cui Jie, Awni M. Khasawneh, Colm Larkin, Hamid El Naimiy, Tshiamiso Makwela, Giulio Mazzolo, Farseem Mohammedy, Magda Moheb, El-Fady Morcos, Surhud More, Thomson Mucavela, Assia Nechache, Li Peng, Eduardo Penteadó, Frederic Pitout, Markus Pössel, Gilles Remy, Sara Ricciardi, Emmanuel Rollinde, Somaya Saad, Gwen Sanderson, Stefano Sandrelli, Hyunjin Shim, Anna Sippel, Jungjoo Sohn, Abdelhafidh Teyehi, Alessandra Zanazzi, Jin Zhu.

In addition to the efforts from the OAE office in Heidelberg, Germany, the following OAE Centers and Nodes made key contributions to organising this event:



Arabic-Speaking Community Discussion

Session organisers: El-Fady Morcos (Egypt), Magda Moheb (Egypt), Somaya Saad (Egypt), Hamid El Naimiy (UAE), Awni M. Khasawneh (Jordan), Mashhoor Al-Wardat (Jordan), Ahmed Chaalan (Lebanon), Ali Al-Edhari (Iraq), and Mohamad Alassiry (Syria)

DISCUSSION SUMMARY

Within the framework of the expansion of Arab cooperation at all levels, the aim of this session was to extend the horizons of the Arab cooperation to include Astronomy Education in the Arab world and to exchange experiences in this field. We discussed the systems and curricula of astronomy education in Arabic-speaking countries and the role of the Arab cooperation in the areas of Astronomy Education, Development and Outreach. The main topics addressed were, Astronomy curricula in the Arab world between the reality and the hopeful; Suggestions about ways to expand the Astronomy Education for the pre-university stages; Teaching astronomy as part of the basic sciences, mathematics, physics, chemistry, engineering, and geography; the role of modern technologies in the development of astronomy education.

The session comprised of talks by speakers from different Arabic-speaking countries. The first speaker was Mashhoor A. Al-Wardat (NAEC) focused on the role of private and governmental educational institutions, planetariums, and bodies specialised in developing learning and teaching methods, especially interactive ones, in the horizons of space and astronomical sciences. We briefly discussed the role of each of these institutions, and present in detail the role of the University of Sharjah, represented by Sharjah Academy for Astronomy, Space Science and Technology (SAASST), in employing its scientific and technical competencies in developing the education sector. The talk also clarified that all specialised institutions in astronomy and space sciences in the country, in cooperation with the Ministry of Education, have contributed to the establishment of workshops to provide teachers with the necessary skills to teach these sciences. Manufacture of cubic satellites and launched several specialised professional diplomas, some of which were allocated for gifted school students and others for the distinguished in cooperation with the Sharjah Education Council, and several astronomical camps were set up to train students and teachers in a practical way.

As a result of all this over the past seven years, the number of those interested in these sciences increased, the number of students enrolled in the physics and aerospace engineering departments in universities increased, and several programs at the graduate level were launched in these disciplines in state universities.



The second speaker Ali Al-Edhari (NAEC, Iraq) presented the contents of the astronomy curriculum in Iraq for the initial (pre-university) stages. The speaker focused on the problems teachers face when they are teaching the astronomy content to the limit that some teachers skip teaching the astronomy part. The speaker mentioned that, there are no specialised school courses in astronomy. Instead, astronomy content can be found in science and physics public and private schools curriculum; General Science (years 1-6 of primary school) and Physics (years 7-12) of secondary and high school.

The experience of teaching astronomy at the undergraduate level and the draft school curricula for teaching astronomy in Lebanon was discussed by Jan Pierre Seghini (NAEC, Lebanon). The speaker highlighted the main weaknesses in curricula and method of teaching astronomy and suggested some solutions. With respect to Lebanon, the speaker mentioned that Astronomy is taught only as a special course in four private universities in Lebanon, not public universities, and there is only one university that offers a Master's program in astrophysics, and also one university to offers a doctorate program. Government schools do not have astronomy in the curriculum but some private schools have included geography and scientific curricula. A proposal has been submitted to the Ministry of Education to update the curriculum at three educational stages in cooperation with the Institute of Science and Development.

Awni Khasawneh (NAEC) and Dalal Ellalla (astronomy trainer) discussed the astronomical topics in the Jordanian school curriculum. In their talk they mentioned that education in Jordan is considered as one of the best education systems in the Arab world. Education plays a pivotal role in the life and culture of Jordanian society, which has lead to allocating 13% of the Jordanian government budget for 2022 to the education system. The speakers highlighted the role of the Jordanian Ministry of Education and Higher Education, the Arab Union for Astronomy and Space Sciences and other societies in supporting educational programs by organising events, activities, workshops, conferences, and astronomical camps. Many specialised astronomical courses are offered in the field of education such as the astronomy teacher course, and an astronomical skills course for teachers.

The last talk was by Abd El Fady Morcos (Deputy manager, OAE Center Egypt) about evaluation of astronomy curricula in Egypt and development mechanisms. The speaker mentioned the future plan, which is divided into six main themes, namely: teachers, curricula of different stages of education in Arabic, preparing astronomical material, student axis, surrounding Arab countries and popular, amateurs and astronomy associations. For the first theme, teacher training workshops (three courses) about teaching Astronomy have been organised in the past and will be repeated. An analytical study for the curricula of astronomy for the stages of pre-university stage was undertaken and efforts are being made to setup a parallel course to help students and teachers. Simple models of some astronomical devices have been prepared and social media sites containing astronomical information are developed. Students are encouraged to visit Helwan and Kottamia observatories and camp in Kottamia for an observing night. Astronomical books and booklets for student and the general public have been published. The main problems faced in Egypt are that the teachers do not have free time to attend training courses; the training programs are not formalised with the ministry of education; administrative contact in the ministry of education is difficult; consultants and supervisors do not easily accept changes in the curriculum.

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