


Empowering Science Teachers in Indonesia through NASE Workshops

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Abstract. Youths and kids in Indonesia since almost two decades ago have been showing significant increase of interest in space sciences, especially astronomy. One of the main factors is due to the annual event of National Science Olympiad which includes Astronomy as the subject. The increasing level of public interest, especially younger generation on astronomical events, such as eclipses, moon sightings, meteor showers has been constantly observed from time to time. Being aware that Astronomy course does not included in primary and secondary education level's curricula, teachers are somewhat desperate and are not capable to play role as clearing house in science related to space. The IAU Network of Astronomy for School Education Network (IAU-NASE) course was started in 2016 in Machung University, East Java as the pilot project in Indonesia. The course has attracted significant interest from teachers and university staff, especially in East and Middle Java Provinces. Being confident with the enthusiasm of teachers who expressed that NASE course could fulfil their needs to teach and instruct students in a very efficient way, it was organized consecutively at Bandar Lampung, Lampung Province in 2018 and 2019 (hosted by Institut Teknologi Sumatera) and in 2020 at Bandung, West Java Province (hosted by Institut Teknologi Bandung). The most recent NASE course on 21–23 August 2020, conducted in on-line mode, was attended by 74 participants, although primarily aimed at 15 School teachers, and was quite successful. The on-line observational activity turned out to be the most impressive session for the participants. We report and review four years of IAU NASE courses in Indonesia, with various documentation and brief analysis of the positive impact to the teachers and instructors attitude in teaching astronomy at secondary level of education.

Keywords. Astronomy, Education, NASE

1. Background

In 2004 the annual astronomy olympiad was introduced in Indonesia. This event was held to encourage young teenagers in Indonesia, especially high school students, to deepen their knowledge and skill in space sciences. Despite lack of astrophysics contents in the curriculum, students have been showing great interest in the competition. This national astronomical olympiads form a structured framework of event capable of reaching out to and motivating high-school students to study astronomy and astrophysics, rewarding theme at each step ([Stachowski & Sule 2019](#))

The proliferation of astronomical clubs and communities in Java Island with addition of some clubs in Sumatra Island and South Sulawesi stimulated young pupils to expose themselves onto astronomical problem solving oriented activities. Astronomical events such as lunar crescent, solar and lunar eclipses, meteor showers are among the most popular and very much awaited by public, especially, students. Astronomy learning, thus, is not concentrated in a certain area but spread across the country. The need of distance learning for astronomy development to overcome barriers in delivering education to the grassroot is needed since 2015 (Yamani & Malasan 2015)

There is a growing number of science teachers who demand practical science trainings to equip them better in the classrooms. Nevertheless, since science teachers in the secondary level education for the whole country outnumber professional instructors available to train astronomy, besides lack of vision from most of school principals and education board in the province, this demand can not be fulfilled immediately and timely, to catch the constant growing of interested students and to match timeline of annual science competition. The Ministry of Education & Culture has spent considerable length of time to adopt astronomy as one of the branches in the National Science Olympiad. In 2007 Astronomy became part of this national event. It is not surprising that in the district level, more than 10,000 students participated in the contest (Wiramiradja & Kunjaya 2006)

In this regard, the IAU-Network for Astronomy School Education (IAU-NASE) whose goal is to train science teachers in the secondary level of education is needed.

2. Network of Astronomy for School Education (NASE) course in Indonesia

NASE course, comprises of series of lectures, workshops and practical observations preferably in mother language of hosting country, provides effective means for teachers to make simple practical tools to support teaching in the class. NASE course promotes active learning process in astronomy by doing real activities such as observation of astronomical objects and phenomena.

The 1st NASE course in Indonesia (or the 82nd International NASE course) was held in Malang, East Java. Hosted by MaChung University whose Rector is an astronomer, it was participated by 34 participants mostly from East and Central Java provinces on the period 25–28 July 2016. Four instructors: from Argentine (Beatriz Garcia), Indonesia (CK), Japan (Akihiko Tomita) and Spain (RMR) were fully involved in the activities, including translation of original materials into Indonesian language and composing structure of course. The structure of NASE course has been specified by identifying local requirement prospect of development by also referring to the existing educational curricula in secondary level of education in Indonesia. It was thought that issues like local wisdoms which take advantages from astronomical phenomena and archeo-astronomy are suitable to be incorporated in the course, especially in Indonesia. An excursion to Badut Temple (*Candi Badut*), the oldest Hindu temple in East Java was arranged. As stated in the local newspaper, Astronomy is an effective bridge for pupil to gain passion on general science. Science teachers should prepare and equip themselves better to deliver contents of astronomy to pupils since early stage of education. Participants in this first course were appointed as local instructors for Indonesia.

After being absence for a year, the NASE course was resumed in 2018 right after the occasion of the 10th Southeast Asia Astronomy Network (SEAN) meeting, and in 2019. It was fully hosted by Institut Teknologi Sumatera (ITERA) who administer the ITERA Astronomical Observatory in Lampung. Similar to first NASE course, a preparation stage consisting of updating translated materials, training for six local instructors who are lecturers in ITERA. Contents of workshops, lectures are all follow closely to

(Ros & Hemenway 2015). A wider spectrum of audience were interested in joining the NASE course in Lampung. It consisted of undergraduate students, member of astronomical communities, beside science teachers in high schools. Most of participants came from Sumatra Island, with a few from Java Island.

Structure of NASE course adopted for activities in Indonesia in 2018 and 2019 comprises of Four Lectures delivered by professional astronomers, i.e. Stellar Evolution, Cosmology, History of Astronomy and Solar System; Ten Workshops led by instructors, i.e. Local horizon and watches of sun, Movement of the stars, the sun and the moon, Stages and Eclipses, Briefcase from the young astronomers, Solar spectrum and sunspots, Life of stars, Astronomy beyond the visible, Expansion of the Universe, Planets and exoplanets, and Preparation of observations; Excursion to nearby potential archaeoastronomy sites, museum, old library. Participants and instructors investigate and discuss astronomical ingredient of the visited site. In 2018 a visit to Lampung Regional Province Museum was arranged, while in 2019 participants were taken to *Pugung Raharjo*, a compound of relics from the megalithic period such as statues, punden terrace, corpses stones, altars, menhir, hollow stones and dolmen.

In mid-2020, the world is facing Covid19 pandemy. Therefore the conventional NASE course must be reshaped to match the situation and to adopt the tight health protocol. Visiting a venue for workshop was impossible. The NASE course 2020 hosted by Institut Teknologi Bandung (ITB) and supported by instructors from ITERA was then decided to be conducted by means of on-line platform. We composed a 32-hours course in full on-line mode by means of Zoom platform. The first plan of course was aimed at 15 teachers in Bandung city, but later we decided to broaden the audience. As a result, a total of 74 participants ranging from high school pupils up to university lecturers were enrolled in the course. It is interesting to learn that college student significantly occupies 50% of total participants. These college students are mostly active in astronomical clubs and communities. Two weeks prior to the course, Local Organizing Committee distributed materials and moduls packed in a kit, put it on google drive and delivered it through post office to registered participants. All participants then prepared materials for workshop two days before the course is commenced. For the entire course, participants created ten teaching aids they learnt from the activity in NASE workshop. These include a Sundial, a Star demonstrator, a solar demonstrator, set of ruler, simplified quadrant, horizontal goniometer, and planisphere, a Solar structure, a Spectrometer, and a Rocket. Furthermore, activities that need to be carried out outdoor or need interactions between instructors and participants were all displayed by means of demo videos provided by NASE.

The most attractive activity which is a new feature in NASE course conducted in on-line mode, is the real-time observations. An instructor situated in Lampung Province, set up a portable 20 cm telescope equipped with a ZWO ASI 178 mm camera and all-sky camera. Supported by a modest internet connection, ZWO software, PC and Zoom platform, instructor spent about two and a half hours showing Jupiter and Saturn in real-time to participants who are distributed throughout the country (see Fig. 1).

3. Implications

Network of Astronomy for School Education (NASE) course comprises of lectures, workshops and practical observation has been providing the teachers of how to teach astronomical theory easier and more attractive to pupils regardless its level of education. In particular the workshops have been helpful for the teachers to device their own teaching aids. These teaching aid can be made easily, and the theory behind it is easy to understand.

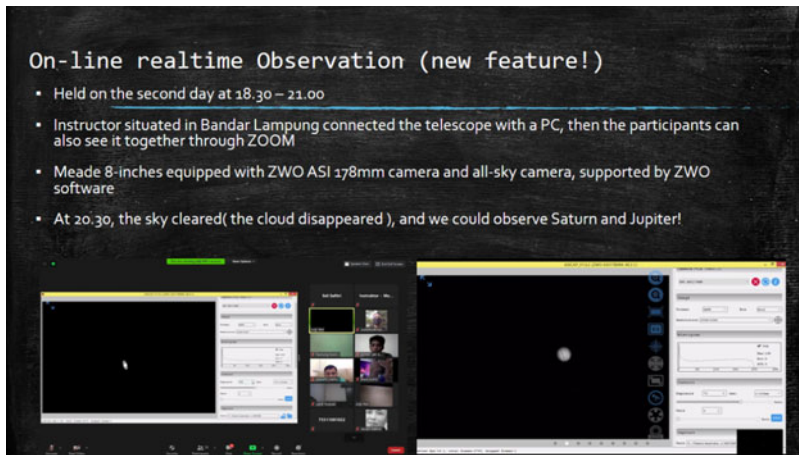


Figure 1. Real-time observation in on-line mode for participants in NASE course.

The amateur astronomers along with astronomical communities who usually held public events for kids sometime run out of ideas on how to make practical astronomy more interesting and easy to understand by children as young as pre-school ages (even to toddlers!). Thanks to NASE course, several workshops have been inspiring and successfully gave fresh ideas to deliver contents of astronomy by asking children to take part in the activities.

Many of the participants in previous NASE course in Malang, East Java (2016) are in fact consistently participate in the following course. It is interesting that they mostly came to the following course at their own expense. The major change in NASE course conducted in Bandung (2020) through distant learning by common on-line platform was positively responded by potential participants. The large number of participants in the on-line NASE course shows large interest. It is recommended that in the future on-line NASE course not only be aimed to registered participants but could also be opened to general public.

To conclude, it is proven through the NASE courses in Indonesia since 2016, what NASE has provided is beyond participants expectation. They have real experience and adventure on education, engagement and learning.

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