Network for Astronomy School Education for Indonesian Teachers (2016-2021)

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ABSTRACT
The first NASE (Network for Astronomy School Education) course in Indonesia was held by Ma Chung University under the support of International Astronomical Unit (IAU) in 2016. Then, Institut Teknologi Sumatera also conducted NASE courses in 2018 and 2019, and then followed by means of virtual courses at Institut Teknologi Bandung in 2020 and Universitas Ahmad Dahlan in 2021. These programs were attended by 5 IAU Instructors, 8 Local Instructors, and 207 Participants in total. The participants were teachers, high school students, lecturers, undergraduate students, and astronomy communities from several regions in Indonesia. NASE course program consists of 4 lectures, 10 workshops, and astronomy visits. We visited Candi Badut (an archaeological site, the oldest Hindu Temple in Java Island) in 2016, Lampung Museum (historical tourist destination for education, research, and recreation) in 2018, Pugung Raharjo (a site of relics from the megalithic period such as statues, punden terraces, corpse/cage stones, stone altars, menhirs, hollow stones, and dolmen) in 2019 and Museum Muhammadiyah (an Islamic center for education and recreation) in 2021. NASE courses improve science teachers' understanding of concepts and practical competences in astronomy. It also stimulates advances in teaching abilities so their students can increase their interest in learning astronomy.

Keywords: Astronomy – Education – Teacher.

1 INTRODUCTION

NASE (Network for Astronomy School Education) was developed in response to 10 Years Strategic Plan of IAU (International Astronomical Union) to increase the efforts of IAU in schools. NASE was founded in August 2009. The goals are to educate teachers and help them to develop astronomy education in their countries (Ros, 2012). Technically, one or two members of NASE visited the host countries, and they teach teachers with the help of local lecturers of astronomy. However, not only visiting once, in fact, NASE always follows the develop of the visit results in each country. The aim is to establish a local group of NASE members from each country, who continue teaching at NASE events each year and create new trainings using NASE materials. NASE provides facilities for teachers to make instruments for understanding astronomical concepts. In addition, NASE also promotes an active learning process by practice using self-made instruments (Ros & Garcia, 2013).

Conditions of astronomy education in Indonesia can be described as follows,

- Astronomy is not an independent subject; it is possibly part of physics or geography.
- Students who follow annual event of National Science Competition, face difficulties.
- Many school teachers do not have sufficient astronomical background.

Based on these situations, Universitas Ma Chung initiated the NASE basic training in Malang (2016). Then, Institut Teknologi Sumatera (ITERA) had the opportunity to host NASE in 2018 and 2019. After that, it was continued by Institut Teknologi Bandung (ITB), in collaboration with ITERA, held NASE basic training for teachers virtually in 2020. And then, Universitas Ahmad Dahlan, Yogyakarta held a virtual NASE training assisted by ITERA and ITB teams in 2021.

2 NASE COURSES IN INDONESIA

NASE programs include 4 lectures (Stellar Evolution, History of Astronomy, Cosmology, and Solar system), 10 workshops (Local Horizon and Watches of Sun, Movement of the Stars, The Sun and the Moon, Stages on eclipses, Briefcase from the Young Astronomer, Solar Spectrum and Sunspots, Life of Stars, Astronomy Beyond the Visible, Expansion of the Universe, Planets and Exoplanets, Astrobiology), and Excursions to introduce Archeoastronomy in the respective region (Ros & Hemenway, 2017). See Table 1 for details.

2.1 NASE in Universitas Ma Chung, Malang (2016)

The first NASE in Indonesia held on July 2016. The most of the participants of this course were

Table 1. Details of NASE courses in Indonesia.

	2016	2018	2019	2020	2021
IAU Instructors	**Rosa M. Ros** (Spain) **Beatriz Garcia** (Argentina) **A. Tomita** (Japan) **C. Kunjaya** (Indonesia)	**Rosa M. Ros** (Spain) **Alexandre C.** (Portugal) **H. L. Malasan** (Indonesia)	**A. Pickwick** (UK) **C. Kunjaya** (Indonesia) **H. L. Malasan** (Indonesia)	**Rosa M. Ros** (Spain) **C. Kunjaya** (Indonesia) **H. L. Malasan** (Indonesia) **Aprilia** (Indonesia)	**Rosa M. Ros** (Spain) **C. Kunjaya** (Indonesia) **H. L. Malasan** (Indonesia) **Aprilia** (Indonesia)
Participants	34 (East and Central Java)	18 (Lampung and West Java)	21 (Lampung and West Java)	74 (13 provinces)	60 (34 provinces)
Dates	25-28 July 2016	22-25 October 2018	19-22 August 2019	13-15 August 2020	12-15 August 2021

teachers. Besides them, it was participated also by high school students and communities of astronomy in East Java (Malang Astronomy Club) and Surabaya Astronomy Club. They were invited to join the excursion in *Candi Badut* (an archeological site), the oldest Hindu Temple in Java Island. Figure 1 shows a picture of the participants taken in this event.

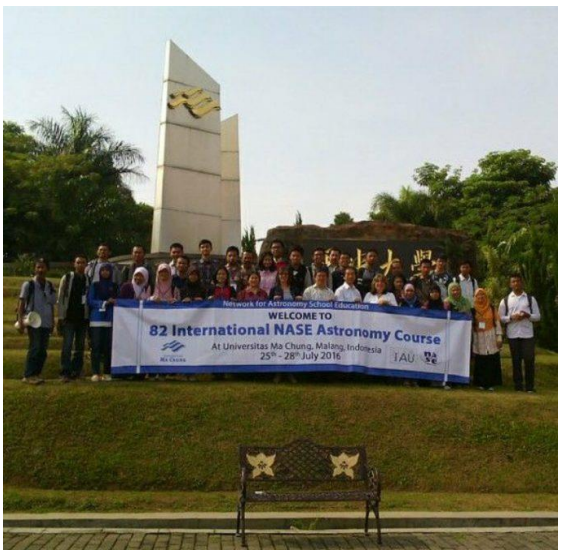

Figure 1. All of participants and instructors in NASE 2016.

2.2 NASE course in Institut Teknologi Sumatera, South Lampung (2018)

In 2018, NASE course was attended by 18 participants from Lampung, Jakarta, Bandung, Malang, Jombang, and Surabaya. They were invited to visit *Museum Lampung*, a historical site visit for education, research and recreation. In the museum, there are unique collections. In there, we saw Chinese zodiac bowl. This bowl indicated that ancient people had known about zodiac (stellar constellation in ecliptic). Besides that, the participants involved in workshops, one of them was about scale of distance (Figure 2).

Figure 2. Scale of distance: workshop for understanding about scale of interplanetary distance in Solar System.

2.3 NASE course in Institut Teknologi Sumatera, South Lampung (2019)

In 2019, there were 21 participants, consist of teachers, undergraduate students, and astronomy communities. At that time, they visited *Taman Purbakala Pugung Raharja*, an archeological site complex, where there are relics from megalithic period such as statues, punden terraces, corpse stones (cage stones), stone altars, menhirs, hollow stones, and dolmen. The interesting object that had been found is a stone that was suspected to function as a compass. The understanding of direction shows that at ancient time they already seen the regularity of the sky movement. Activity in *Pugung Raharjo* is displayed in Figure 3.

2.4 NASE course in Institut Teknologi Bandung, Bandung (2020)

The following NASE course was held on August 2020, by ITB Bandung. This course was participated by 74 participants from 13 provinces in Indonesia. They were lecturers, undergraduate students, teachers, communities, and high school students. One of our activities was making instrument to understand about expansion of universe (Figure 4).

Figure 3. Astronomical Excursion to *Pugung Raharjo*. The tour guide introduced Archeoastronomy in Lampung.

Even though it was the first virtual NASE due to the pandemic outbreak, participants commented that NASE course was very helpful and it was beyond their expectations.

Figure 4. Expansion of Universe workshop: Understanding expansion concept using balloon.

2.5 NASE course in Universitas Ahmad Dahlan, Yogyakarta (2021)

In 2021, NASE was still held virtually due to the pandemic. It followed by 60 participants from 34 provinces. They are member of PPFI (*Perkumpulan Pecinta Fisika Indonesia*), undergraduate students from Universitas Ahmad Dahlan, and public. Even though this course was held virtually, the participants were invited to join the virtual excursion in *Museum Muhammadiyah,* an Islamic center for education and recreation. They listened to the

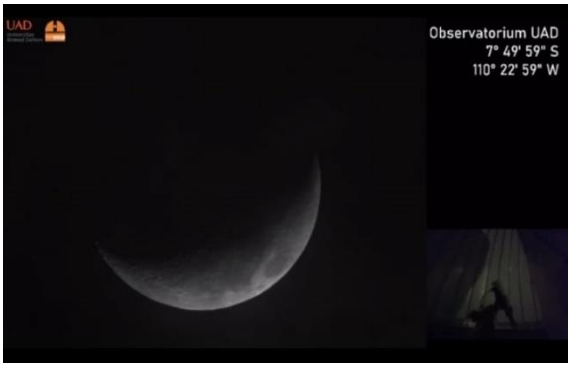

Figure 5. Universitas Ahmad Dahlan as the host of NASE course in 2021, conducted Lunar observation virtually.

explanation about *Muhammadiyah* role of astronomy development in Indonesia and the world. For example, Muhammadiyah contributed in the rocket launching by Indonesian scientists, Islamic calendar arrangement, and observatory construction. Besides that, participants were also invited to join virtual observation (Figure 5).

3 CONCLUSIONS

NASE can improve understanding of concepts and practices in astronomy for teachers. It also makes advances in teaching abilities so their students can increase their interest in learning astronomy.

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