






ASTRONOMY EDUCATION THROUGH DIGITAL MEDIA

MARINA S. PAVLOVIĆ¹ , DRAGANA ILIĆ² ,
JELENA KOVAČEVIĆ-DOJČINOVIĆ³ , MILICA M. VUČETIĆ² 
and MONIKA I. JURKOVIĆ³ 

¹*Mathematical Institute of the Serbian Academy of Sciences and Arts,
Kneza Mihaila 36, 11000 Belgrade, Serbia*

²*Department of Astronomy, Faculty of Mathematics, University of Belgrade,
Studentski trg 16, 11000 Belgrade, Serbia*

³*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia
E-mail: marinap@mi.sanu.ac.rs*

Abstract. In order to bring astronomical content to pupils all across Serbia, which is not part of regular school curricula, and to increase their interest in astronomy, we organized an astrophotography contest called "Take a Photo of the night sky". The contest was intended for primary and high school pupils, whom we invited to submit one photo taken with a mobile device in teams of no more than 5 pupils, under the supervision of a teacher. As part of the contest, professional training was organized for registered teams on how to make successful astrophotography using a mobile device (phone or tablet). A total of 184 teams from all over Serbia participated in the astrophotography contest, including more than 1,400 pupils and 200 teachers from all over the country. The astrophotography contest was organized by NAEC (National Astronomy Education Coordinators, representing the International Astronomical Union's office of Astronomy for Education) Team Serbia with the great support of four major astronomical institutions in Serbia: the Society of Astronomers of Serbia, the University of Belgrade - Faculty of Mathematics, the Astronomical Observatory in Belgrade, the Mathematical Institute of the Serbian Academy of Sciences and Arts.

1. INTRODUCTION

In Serbia, astronomy topics are included in the primary school curriculum, specifically within the subjects of Natural History (4th grade) and Geography (5th grade) (Atanacković 2017, 2018). Furthermore, some dedicated teachers in physics, mathematics, or geography organize astronomy clubs to provide additional learning opportunities. In 1990, astronomy topics were integrated into the fourth-year Physics course. Students study various aspects, such as gravity, celestial coordinate systems, time measurement, distances to celestial bodies, physical processes, radiation, astronomical instruments, the Sun, the Solar system, stars, galaxies, and cosmology (Atanacković 2017, 2018). It is worth noting that only a small number of special schools in Serbia, including the Mathematical High School in Belgrade, Zemun Gymnasium, Gymnasium Svetozar Marković in Niš, and Jovan Jovanović Zmaj in Novi Sad offer astronomy as a standalone course.

Bearing in mind the above, for the purpose of popularizing astronomy and improving astronomy education in Serbia, it is very important to introduce extracurricular activities in both primary and secondary schools throughout Serbia. One such example is the Petnica Science Center (PSC), established in 1982. PSC is not part

of formal education, however, it plays a significant role in providing extracurricular education for talented secondary school students (Vukadinović *et al.* 2021).

The dissemination of public astronomy education primarily relies on the activities of 23 amateur astronomical societies and clubs located across Serbia. Moreover, lectures are regularly held in two planetariums, one in Belgrade and the other in Novi Sad, which in addition to weekly popular scientific lectures, also organize school visits to planetariums, as well as night and day telescope observations during important astronomical events. The use of a mobile planetarium as a tool for astronomy communication is also a part of the educational outreach efforts, organized by the Society of Astronomers of Serbia, one of the most important bodies for the popularization of astronomy in Serbia (Atanacković 2018).

Since 2020, extracurricular activities have also been carried out by the National Astronomy Education Coordinators (NAEC) team for Serbia. In January 2020, the Office of Astronomy for Education (OAE) was established to enhance astronomy education worldwide, with a focus on schools. This office joins the three existing ones under the International Astronomical Union's (IAU) Commission C1 on Astronomy Education and Development: the Office for Astronomy Development (OAD), the Office for Young Astronomers (OYA), and the Office for Astronomy Outreach (OAO). In its efforts to achieve this mission, the OAE has initiated the formation of a network of NAECs. The National Committee for Astronomy of Serbia took the initiative to nominate the current Serbian NAEC team, with the team chair Dragana Ilić, who replaced Prof. Dr. Olga Atanacković, who significantly contributed to the improvement of astronomy education in Serbia working as the president of the NAEC team in the period of 2020-2021. The team members are of Jelena Kovačević - Dojčinović, Milica Vučetić, Bojan Arbutina and Marina Pavlović. The primary responsibilities of each NAEC team include assisting the OAE in documenting and analyzing the incorporation of astronomy within the educational curriculum of their respective country. This involves identifying relevant ongoing initiatives, coordinating professional development opportunities for teachers, and creating accessible, high-quality educational literature customized to address the specific requirements of the country. Furthermore, NAEC teams serve as a crucial link connecting their national astronomy education community with both the OAE and the IAU. For three consecutive years, the OAE has been organizing a global astrophotography competition, attracting young individuals and bringing astronomy closer to them through digital devices, which they are accustomed to in their daily lives.

Motivated by the successes achieved in this contest, we organized for the first time a contest in astrophotography for elementary and high school pupils, titled "Take a Photo of the Night Sky", which was launched in late 2022. This astrophotography contest holds significant importance in the education of young individuals, enabling the development of critical thinking skills. By encouraging pupils to capture the night sky through astrophotography, the contest not only promotes an interest in astronomy but also cultivates observational and analytical abilities. Through hands-on engagement, participants gain a unique opportunity to explore scientific concepts, enhancing their overall education experience.

2. THE CONTEST "TAKE A PHOTO OF THE NIGHT SKY"

Driven by the desire to introduce pupils to new content and tackle their interest in the natural sciences, particularly astronomy, the NAEC team for Serbia, organized the first astrophotography contest in Serbia for elementary and high school pupils. This contest¹ ran from December 2022 to April 2023 and received a significant response from pupils across the country. Nearly 1,400 pupils, grouped into approximately 400 teams, under the guidance of around 400 teachers, enthusiastically took part in this contest.

The contest was supported by four major institutions in Serbia with professional astronomers: The Society of Astronomers of Serbia, Astronomical Observatory of Belgrade, Faculty of Mathematics - University of Belgrade, Mathematical Institute of the Serbian Academy of Sciences and Arts, and partners from the private sector, United Cloud and EPSON Serbia, who provided valuable prizes for the winners.

2. 1. PROPOSITIONS

Participation in the contest was open to teams consisting of 1 to 5 pupils from the same elementary or high school, and each team should include a teacher. A single teacher had the option to register multiple teams for the contest, but the team members had to be different individuals. The essence of astrophotography revolves around capturing images of the night sky and celestial objects, including planets, stars, nebulae, and galaxies. To qualify as astrophotography, the photo had to be taken at night and had to showcase a celestial event, such as the Milky Way, the Moon, a star cluster, a constellation, or simply the night sky captured through long exposure to reveal star trails. Additionally, various types of nightscapes containing elements of astrophotography were also accepted.

Each team was allowed to submit only one astrophotography. What makes this contest distinctive is its requirement for participants to capture photographs exclusively using mobile phones or tablets, ensuring equal opportunities for a larger number of children. The use of additional equipment like adapters and stands was permitted. Moreover, the submitted photographs had to include an EXIF file containing complete information about the photography process. Instructions on how to generate this file were provided during the professional training which is going to be presented in the next section. The minimum resolution for the photographs was set at 3000 pixels on the longer side, and the accepted format was jpeg. Participants were allowed to edit their photographs using image processing software. In addition to the final edited photograph, participants were required to submit the original, unprocessed photo. If the final edited photograph was a composite of multiple consecutive shots, only one original unprocessed photograph needed to be selected and submitted.

2. 2. PROFESSIONAL TRAINING

Prior to the contest, participants had the chance to learn the art of successfully photographing the night sky with ordinary mobile devices through an online training session led by expert collaborator and jury president, Vladimir Kržalić. The central objective driving the training initiative was to promote equal opportunities for all pupils and to illustrate that individuals, irrespective of their background or prior

¹<https://sites.google.com/view/uslikajnocnonebo/home>

experience, could actively participate in and generate professional astrophotography with simple mobile devices and basic training. The recording of the training was available to all participants until the end of the deadline for submitting final photos.

3. RESULTS

Approximately 200 teams submitted successful astrophotographs for evaluation. These photographs underwent a rigorous assessment by a panel of expert jury, which included Vladimir Kržalić (jury president), Miodrag Sekulić, Dr. Marina Pavlović, and Prof. Dr. Tijana Prodanović. In a highly competitive field, the jury carefully selected the top three photographs.

The first prize was awarded to the "Milky Way" team, composed of third-grade pupils from Požarevac High school: Boban Janković, Bogdan Milaković, Nikola Milaković, along with their teacher, Mirjana Živojinović. Their photograph (Fig. 1) is titled "Traces of Stars above the Roofs of Požarevac on a February Evening" and was captured using a Xiaomi Redmi Note phone.



Figure 1: "Traces of Stars Above the Roofs of Pozarevac on a February Evening" (the First prize). Authors: Boban Janković, Bogdan Milaković, Nikola Milaković (Požarevac).

The second prize was earned by the "OŠ Siniša Janić" team, formed of eighth-grade pupils from the "Siniša Janić" Elementary School in Vlasotince: Nina Antić, Jana Gorunović, Isidora Ilić, and Sofija Stojanović, along with their teacher, Tatjana Mihajlović. Their photograph (Fig. 2) is titled "Starry Sky above the Old Cemetery (Memorial Park) in Vlasotince" and was taken using an iPhone 14 Pro Max.

The third prize was secured by the "Vuk1" team, composed of seventh-grade pupils from the "Vuk Karadžić" Elementary School in Belgrade: Filip Bobačev, Mihajlo Petrović, Ema Radulović, Dunja Stojković, and Nina Šušić, under the guidance of their teacher, Marina Lakčević. Their photograph (Fig. 2) is titled "Night Sky at the Foot of the Dinara Mountains in Dalmatia" and was captured using a Samsung S20 F phone.



Figure 2: Left: "Starry Sky above the Old Cemetery (Memorial Park) in Vlasotince" (the second prize). Authors: Nina Antić, Jana Gorunović, Isidora Ilić, and Sofija Stojanović. Right: "Night Sky at the Foot of the Dinara Mountains in Dalmatia" (the third prize). Authors: Filip Bobačev, Mihajlo Petrović, Ema Radulović, Dunja Stojković, and Nina Šušić.

Additionally, a special award, the model of the solar system was given to the youngest team, consisting of first-grade pupils from "Svetozar Marković" Elementary School in Kragujevac.

3. 1. AWARD CEREMONY

The announcement of the winners and the awards ceremony took place on April 1st, 2023, at the Astronomical Observatory of Belgrade. The top three teams were given valuable prizes in the form of school telescopes, while the top 15 teams received symbolic gifts. At this event, the participants had the chance to meet the organizers and representatives of all institutions that participated in the organization, as well as to talk with them and exchange ideas and materials about astronomy education. Furthermore, during the event, all attendees had the opportunity to explore the Astronomical Observatory, where they could see the Great Refractor, one of Europe's largest telescopes during the first half of the 20th century.

A special exhibition titled "Take a Photo of the Night Sky" was opened on this occasion in the Great Refractor Gallery at the Astronomical Observatory. It showcased the 15 best-placed astrophotographs, making the most outstanding works of elementary and high school pupils accessible to a broader audience. This exhibition remained open until the end of November 2023 and welcomed numerous visitors, including officials from the embassies of Russia, China, and the United States of America.

4. SUMMARY

In this paper, we described the first astrophotography contest for elementary and high school pupils, titled "Take a Photo of the Night Sky." The contest was organized by the NAEC team for Serbia in collaboration with various partners, including the Society of Astronomers of Serbia, the Astronomical Observatory of Belgrade, the Faculty of Mathematics - University of Belgrade, the Mathematical Institute of the Serbian Academy of Sciences and Arts, and corporate partners the United Cloud and EPSON Serbia.

Prior to the contest, registered teams had the opportunity to participate in professional training sessions on how to create quality astrophotographs using mobile phones or tablets. This unique aspect of the contest ensured equal opportunities for all registered participants. The contest brought together over 1,500 teachers and pupils from all over Serbia, making it the largest astronomical event of its kind in the history of Serbia.

In addition to the enormous interest of schools and pupils, our contest received great attention from the general public and media. Both the launching and the announcement of the winners were covered by major Serbian news agencies, as well as the local news. Moreover, our contest and one of the winners were featured in the IAU journal "Communicating Astronomy with the Public" (CAP), in the issue 32 (page 31) from July 2023².

The plan for the future is to establish this contest as a tradition in Serbia, held every two years, with the aim of attracting an even larger number of participants and imparting astronomical knowledge to young individuals who may not have previously encountered astronomy. The "Take a Photo of the Night Sky" contest offers a unique opportunity for pupils to engage in astronomy education through digital media.

Acknowledgements

We wish to extend our sincere gratitude to all the institutions that have provided us with unwavering support and invaluable assistance. We express our genuine appreciation to our corporate partners United Cloud and EPSON Serbia for providing us with valuable prizes. We are very grateful to the reviewer for his helpful advice and comments. This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (contracts no. 451-03-66/2024-03, no. 451-03-66/2024-03/200002 and no. 451-03-66/2024-03/200104).

References

- Atanacković, O.: 2017, *Publ. Astron. Obs. Belgrade*, **96**, 397
Atanacković, O.: 2018, *Publ. Astron. Obs. Belgrade*, **98**, 91
Vukadinović, D., Milanović, N., Milošević, S., Bošković, M. and Božić, N.: 2021, *Publ. Astron. Obs. Belgrade*, **100**, 363

²<https://www.capjournal.org/issues/32/lowres.pdf>