Astronomy EDUcation Alliance Meeting

High Engagement and Deep Learning of Math, Science and Technology through Astronomy Education

Book of Abstracts

A global astronomy education meeting in parallel with the European Planetary Science Congress and organised by Global Hands-on Universe

Estoril Congress Centre, Cascais, Portugal
08 - 12 September 2014
Scientific Organising Committee (SOC)
Carl Pennypacker – Chair (GHOU)
Eleni T. Chatzichristou (EPSC)
Pedro Russo – Co-chair (Leiden University / Universe Awareness)
Kevin Govender (IAU – OAD)
Rosa Doran (GTTP/GHOU)
Edward Gomez (LCOGT)
Paulo Bretones (IAU Commission 46)
Sofoklis Sotiriou (EA)
Pamela L. Gay (SIUE)
Agata Hidehiko (NAOJ)
Rebecca Barnes (HE Space Operations for ESA)
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Compiled by Thilina Heenatigala and Lina Canas.
Global HOU
Carl Pennypacker, UC Berkeley, USA. Rosa Doran, NUCLIO, Portugal.

Abstract
Over the past 20 years, Global HOU has grown from preliminary concepts to now being a significant engine for science education reform. While every nation has its own educational systems with national challenges, GHOU has proven resilient in adapting to the local education infrastructure, and delivering some of the highest quality science education on our planet. GHOU’s careful support of teachers, attention to curriculum and activities, cultivation of ambassadors and enthusiastic collaborators, and openness to good ideas is still strong and pervasive in our system. The future of GHOU looks better and better over the next decades, and we can look forward to years of growth and reaching more and more students and teachers around the world.

Science everywhere: Teaching Inquiry Learning as a way of Life
Pamela Gay, Southern Illinois University Edwardsville, USA

Abstract
It is often hard for students to understand that inquiry is more than just a thing teachers make them do. In reality, scientific inquiry is a way that students can understand the world around them, both in school and out, and now and in their futures. In this talk, we’ll discuss different ways that real-world inquiry experiences can be brought into the classroom - both normal domestic problems and NASA driven citizen science problems - to give students experience doing inquiry they can continue on their own.
**Astronomy Education 2020: A 5-year Vision**

Pedro Russo, Leiden University / Universe Awareness, The Netherlands.

**Abstract**

Education like science is evolving and mutating (really) fast: every week new technologies, content, techniques and tools emerge and educators have to navigate through this sea of change. But what does this change mean to astronomy education? During this talk I will explore how this trends and ideas will change the next 5-years in astronomy education.

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**Astronomy Education Research: Results and Perspectives**

Paulo S. Bretones, DME/UFSCar/IAU Commission 46, Brazil.

**Abstract**

Astronomy education research may have several applications and motivations. We consider the personal interest of researchers to obtain knowledge, enhance their practice, career advancement and advancement in this field of knowledge. The various forms of production of this research, published in theses and dissertations, proceedings of meetings and journal articles, are addressed. The categories of classification of the papers (by country, institution, grade level, topic, focus of study in education, type of academic research and theoretical framework) in order to investigate this production is presented. Some results obtained from surveys available in the literature of the area are presented with characteristics, trends, gaps and recommendations for future research. Efforts and the potential perspectives are also discussed, showing the particular example of Brazil and a few international initiatives. Some possible improvements are suggested as graduate studies, meetings and publications in journals of regional and international circulation, taking into account the different contexts of production and their application in schools with local teachers and to the general public.
Education @ ESA: Inspiring the Future
Rebecca Barnes, HE Space Operations for ESA, The Netherlands.

Abstract
The purpose of the European Space Agency (ESA) Education Programme is to support Europe’s need to encourage an increasingly knowledge-based society.

The objectives of ESA Education are: to motivate and enable young people to enhance their literacy and competence in science and technology; to inspire and enable young people to consider pursuing a career in Science, Technology, Engineering and Mathematics (STEM) fields, in particular the space domain, and to contribute to increasing awareness of the importance of space research, exploration and applications in a modern society and economy.

This is achieved through a variety of activities designed for specific age groups, by keeping the education community informed about these developments, and providing inspirational materials that assist teachers and students with the learning process.

Innovative Methods in Astronomy Education
Sofoklis Sotiriou, Ellinogermaniki Agogi, Greece.

Abstract
This talk presents a series of innovative approaches in astronomy education. It analyses the operation, development and use of the COSMOS Portal (portal.discoverthecosmos.eu) (Sotiriou, 2008, Sotiriou et al., 2011), an advanced Educational Repository for Science Teaching. This portal has been designed to facilitate science teachers’ search, retrieval, access and use of both scientific and educational resources.

It introduces teachers to an innovative methodology for designing, expressing and representing educational practices in a commonly understandable way through the use of user-friendly authoring tools. COSMOS materials include images, videos, animations, simulations, lesson plans, students projects and teachers guides. The COSMOS Portal is in operation for five years and includes more than 200,000 educational objects while it is supported from a very active community of 5,000 science teachers from many European Countries. The aim of our work up to now was a) to design and deploy a systematic approach for measuring the effectiveness of the COSMOS Portal educational design and b) to prove the significant contribution of the COSMOS Portal to the introduction to the teachers’
communities of a culture of sharing and re-use of educational resources. Numerous data from the COSMOS Portal use were collected through the Google Analytics monitoring system for a long period of time (5 school years). For the analysis of the data and the mapping of the COSMOS Portal users behavior we have use as reference the research work of Ochoa & Duval (2009), who are presenting an quantitative analysis of the size and contributor base growth of educational repositories and the research work of Huberman et al. (1998) who described with the “law of surfing” a common pattern of surfing behaviour of the users of digital repositories. According to the findings the exponential growth of the contributors to the COSMOS Portal is followed from an exponential growth for the uploaded content for a long period of time. The COSMOS users are still contributing numerous educational materials (about 50 learning objects per contributor) while they are visiting the COSMOS Portal again and again. In order to study further these very promising results a series of additional parameters were examined during the initial operation of the COSMOS Portal. These parameters comprises the total number of the COSMOS portal visits; all, new, and returning unique visits; page-views; pages/visit; and a series of parameters that could demonstrate the visitor loyalty like the average time on site per visit; the depth of each single visit (number of pages visited). According to our data a significant behavioral change is identified as the returning users are using more and more frequently the COSMOS Portal in the after-school hours, namely during the preparation of the lessons as it was expected from the educational design of the COSMOS Portal. Additionally we are presenting the results from a quantitative analysis in terms of the power law distribution, estimating the probability for a web-page to be visited by a specific number of users and more. Although its new users follow a typical surfing pattern, returning users outperform this pattern, “foraging” frequently, deeper and longer for the science education content offered by the portal.

Supporting projects and piloting methodologies of ICT use in STEM Education in ERTE
João Carlos Sousa, Directorate-General for Education, Portugal.

Abstract
ERTE is a specific team within the Directorate-General for Education (Direção-Geral da Educação) of the Portuguese Ministry of Education and Science which is in charge of designing, developing and evaluating initiatives and projects related to the use of digital tools and resources in education. It fosters the effective use of computers and Internet technologies by all educational agents (students and teachers alike) and is a partner in several European projects, namely eTwinning, InSafe, iTEC, Living Schools Lab,
Creative Classrooms Lab.

eTwinning offers a platform for staff (teachers, head teachers, librarians, etc.), working in a school in one of the European countries involved in this project, to communicate, collaborate, develop projects, share and be part of the most exciting learning community in Europe. Some Portuguese schools have used this technology-supported network of Educators to develop Astronomy related projects and many more can do it in the future.

inGenious is the European Coordinating Body in Science, Technology, Engineering and Mathematics (STEM) Education. It is a joint initiative launched by European Schoolnet and the European Roundtable of Industrialists (ERT) aiming to reinforce young European’s interest in science education and careers and thus address anticipated future skills gaps within the European Union.

All the actions undertaken in inGenious aim to improve the image of STEM careers among young people and encourage them to think about the wide range of interesting opportunities that STEM can bring to their lives in the future. The role of Astronomy activities in achieving this aim will be discussed.

International Year of Light 2015 Astronomy Programme: Cosmic Light

Sze-leung Cheung, IAU/NAOJ, Japan.

Abstract

The IAU is one of the supporting organisations of the International Year of Light (IYL2015), and the Cosmic Light Projects of IYL2015 is organized by IAU. 5 cornerstones have been established, namely Comic Light EDU, Cosmic Light Awareness, Light: Beyond the Bulb, Quality Lighting Kit and Galileoscope.

The speaker will talk about the plans and the projects about the Cosmic Light projects.

Using Astronomic Data to Teach the Regular Physics Curriculum in High School and College: More than Examples

Vitor Teodoro, College of Sciences and Technology, Universidade Nova de Lisboa, Portugal.

Abstract

In most countries, the physics curriculum changed in the last two decades from “traditional physics” (topics such as simple machines, motion laws, electrostatics, etc.) to more recent topics, e.g., conservation laws, nature of radiation, Universe expansion, sub-atomic particles, etc., and sometimes
astronomy topics, particularly observational astronomy.

In some countries, such as the UK, other new topics and tools are now taught in high school: image analysis, signals, sensors, waves and quantum behaviour, models and mathematical modelling, etc.

In this talk, I will illustrate how some “traditional” topics can be taught using astronomical data, both from historical observations and from recent papers, and I will outline a few principles and recommendations for teachers and curriculum developers and examiners. I will give particularly emphasis on image analysis and computational mathematical modelling using astronomical data.

Astronomy Education Projects in Iceland: Past, Present and Future
Sævar Helgi Bragason, University of Iceland, Iceland.

Abstract
In 2010, every primary school in Iceland received a Galileoscope. In 2013, every school received an Earthball. In 2015, a new and unique project related to the 2015 Solar Eclipse will become a reality in every primary school in Iceland. In this presentation, we will explore the past, present and future state of astronomy education in Iceland, how the International Year of Astronomy and UNAWE participation has helped develop it further. We will also discuss how the small size of the country and population, and its location under the auroral oval present unique opportunities for communicating astronomy.

Navigation Book from GTTP - Tips and Tricks for a Successful Journey in Education
Rosa Doran and Lina Canas, NUCLIO, Portugal.

Abstract
The Galileo Teacher Training Program was born in the shoulders of giants and continues to grow ever since. A short summary of the global stories so far, the bricks and stones and the road ahead. The shared story of a community of scientists changing schools across the world.
Collaboration Between Non-formal Learning and Science Curricula Teaching

Isabel Borges, Planetário Calouste Gulbenkian, Portugal.

Abstract

Never before as today has been such a diverse educational offer of non-formal science contexts. Its objectives are broadly to disseminate ideas, arouse interest in science and promote scientific and technological culture.

But does this type of activities really contribute to the formal teaching of science curricula in schools? Does it promote science education of students?

Along the time, from our teaching experience with a frequent promotion of non-formal contexts and after a reflective process of teacher training practice, we came up with an empirical perception about the potential of non-formal education to facilitate and improve science learning. This perception was confirmed by a study made with 8th grade science students using non-formal education in a science centre. The results showed the acquisition and development of some skills listed in the official science curriculum by students.

Later, as education coordinator in a science centre we apply on the field techniques of pedagogical supervision, trying to clarify some essential characteristics of non-formal contexts for a fruitful collaboration with formal science teaching.

Crossing different looks we got some answers and we raised new questions about the issue of the contribution of non-formal education for teaching science curriculum in school.

Science on Stage: Illuminating Science Education

Rosa M. Ros, vice chair Science on Stage Europe, Ciencia en Acción, Spain.

Abstract

Explaining planets to blind children, developing methods to control a solar balloon or spotting honey bees online: Science on Stage Europe is the platform of and for science teachers of all school levels offering STEM teachers from 25 countries a stage to exchange their teaching concepts and to share ideas like these. The ultimate goal is to improve science teaching by encouraging creativity in science teachers.
In the presentation Science on Stage will show teaching materials such as ICT in Science Teaching or videos of experiments – all made by teachers for teachers. Furthermore an overview about the activities, benefits and possibilities for teachers to participate will be given: the Science on Stage festival 2015 in London, the teacher exchange programme and teacher trainings about e.g. Smartphones in Science teaching or promoting language skills through science teaching.

Science on Stage Europe reaches about 40,000 teachers and teacher trainers in Europe. It is the umbrella organisation that supports the 25 member countries with the realisation of their activities and organises the biannual Science on Stage festival. By spreading good teaching concepts among Europe’s science teachers the network aims to encourage more schoolchildren to consider a career in science or engineering.

Since 2011, Science on Stage Europe e.V. is a registered non-profit association with headquarters in Berlin.

Informal and Formal Education in Astronomers Without Borders Global Programs
Mike Simmons, Astronomers Without Borders, Portugal.

Abstract
Almost all Astronomers Without Borders (AWB) global programs present opportunities for educational components, primarily informal education and outreach. Amateur astronomers conduct informal education through public outreach in grassroots programs with resources provided by AWB and partners, with celestial events and space missions in the news providing an audience looking for information and insights in every country. Online observing sessions conducted by a professional astronomer reach tens of thousands of participants. The AstroArts program presents various art forms in the context of astronomy and space exploration. Global Astronomy Month (GAM), held each year throughout April, allows partner organizations to expand on existing programs through the worldwide community and international reach of AWB, and the attention created by GAM’s slate of dozens of programs. Formal education is a new area for AWB, led by the Telescopes to Tanzania program that is building curricula, training teachers, and changing the culture of science education in this east African country. The success of this sustainable and scalable program suggests that it can serve as a model for other countries in Africa and perhaps elsewhere. AWB actively seeks partners whose programs can benefit from this worldwide platform. Ideas for new program, which generally must be open and accessible to everyone either online programs or through local events, come from both the AWB.
community and partners. All of these programs demonstrate the utility of astronomy as a gateway to other STEM fields in both informal and formal settings, engaging an interested public and sparking interest in science among students.

SkyLight Opera
Oded Ben-Horin, Stord Haugesund University College, Norway.

Abstract
The ‘SkyLight’ Science Opera is an initiative which is inspired by the International Year of Light, and led by Stord Haugesund University College, Norway. During this presentation, the case will be made for cross-disciplinary Science and Arts learning models, exemplified by the Write a Science Opera (WASO) initiative and the Comenius Multilateral project ‘Implementing Creative Strategies into Science Teaching’ (CREAT-IT).
In the SkyLight opera, school pupils from around the world, in approximately 20 countries will collaborate on and, with the help of ICT tools, perform simultaneously a newly-written Inquiry-Based Science Opera about one of the IYL’s themes.

A Virtually Zero Budget Astronomy Communication Program
João Retrê, CAAUL-FCUL, Portugal ; José Afonso, CAAUL-FCUL, Portugal ; Rui Agostinho, CAAUL-FCUL, Portugal.

Abstract
The lack of funding for the dissemination of science is a reality for most institutions doing science communication. Due to its scale and multidisciplinary nature, Astronomy has the ability to attract and captivate a large diversified public - this promotion potential can be used to create innovative collaborations that enhance outreach initiatives. The fascination and wonder awakened in the public, arouses a natural curiosity that originates a constant pursuit for knowledge. Inevitably it arises the need of an increasing number of enthusiastic people that can set a bridge between science research and the public, with combined strong education background and communication skills. Investing and developing
these features in present science students and future researchers is essential in this context.

This talk addresses two main projects that lead to a virtually zero budget Astronomy communication program: synergies established with professionals in various areas of knowledge (e.g. designers, musical artists and movie producers), and the creation of a successful informal and self-sustainable astronomy education program that uses the practice of science mediation and outreach as a way of reinforcing the formal science knowledge and communication skills of over 50 volunteer university students.

ESERO Portugal
Cátia Cardoso, Ciência Viva, Portugal; Ana Noronha, Ciência Viva, Portugal.

Abstract
ESERO (European Space Education Resource Office) is an educational project of the European Space Agency (ESA) that uses Space as an inspiring channel to teach Science, Technology, Engineering and Mathematics (STEM). Its main objective is to motivate students to pursue scientific careers.

The ESERO project is developed in collaboration with national institutions with links to science education. In Portugal, the project was developed with Ciência Viva. ESERO Portugal has its headquarters in Pavilhão do Conhecimento, in Lisbon.

ESERO Portugal develops teacher training courses that are reproduced at national level at the Ciência Viva Science Centres. Our first workshop, under the theme ‘Comets and the Solar System’ had the participation of approximately 100 teachers.

ESERO Portugal promotes ESA activities for students such as CanSat which happened for the first time in Portugal this year, Mission X and Cassini scientist for a day.

ESERO Portugal is also working with the national community of scientists and engineers to promote synergies between the educational and research communities, to adapt space resources to the curricula and inspire students.
The ESERO Project in Belgium
Alvarez Rodrigo, Royal Observatory of Belgium, Belgium.

Abstract
The European Space Education Resource Office (ESERO) is an educative project of ESA aiming at supporting the specific educational needs of the education communities of (some) of the Member States of ESA. Established in Belgium since 2006, ESERO proposes teacher trainings, specific educational material and funding in order to start classroom science projects.

Linking Real Astronomy Research to the Classroom
Fraser Lewis, Paul Roche and Sarah Roberts; Faulkes Telescope Project, UK.

Abstract
We illustrate our experience of allowing teachers and students to use real data and astronomical software, allowing them an insight into the way astronomy research is conducted.

We present examples of scientific analysis of images on objects as diverse as AGN, X-ray binaries, open clusters and asteroids, much of the data being collected using the Faulkes Telescopes, a pair of 2-metre telescopes, located in Hawai‘i and Australia.

We also show how the students and teachers are able to use these techniques to benefit the researchers themselves.
IAU astroEDU: An Open-access Platform for Peer-reviewed Astronomy Education Activities
Thilina Heenatigala, Universe Awareness, Sri Lanka.

Abstract
There are many sources of educational resources for astronomy across the world. The quality of these resources is highly variable making the effectiveness to the end-user an unknown quantity. They are not maintained or updated regularly and have a limited content review. To address these issues and more, astroEDU follows a peer-reviewed process similar to what scholarly articles are based on. Activities submitted are peer-reviewed by an educator and a professional astronomer which gives the credibility to the activities. astroEDU activities are open-access in order to make the activities accessible to educators around the world while letting them discover, review, distribute and remix the activities. astroEDU is endorsed by the International Astronomical Union meaning each activity is given an official stamp by the international organisation for professional astronomers.

Kepler: Latest Activities and a New Mission
Alan Gould, Lawrence Hall of Science - UC Berkeley, USA.

Abstract
Latest results from the Kepler primary mission to find Earth-size planets lead to new education activities, including new uses for online interactive, access to the complete planet databases and light curves with analysis tools, an ongoing exoplanet art project, and more. Also Kepler lives on in a new mission, the K2 mission, with the superb Kepler space telescope photometer unleashed to not just search for planets, but observe variable stars, galaxies and clusters.
Framework of Astronomy Literacy Goals
Erik Arends, Universe Awareness (Leiden Observatory), The Netherlands.

Abstract
We present the findings of our research to create a framework of astronomy literacy goals that is supported by both literature and educational professionals. The American Association for the Advancement of Science (AAAS) set out a number of goals for 2061 to have a well-founded bottom limit for scientific literacy. We take the astronomy-related parts out of this and locate any gaps once they are pieced together. Filling in these gaps based on astronomy education literature, results in a goal for a bottom limit for astronomy literacy that we set out for 2025. We test this top-down with a survey among educational experts. This survey exposes the feasibility of the literacy goals per topic and age group. After analysis of the survey, we revise our initially developed goal for astronomy literacy and publish a final bottom limit to be reached by 2025. In addition, we provide a list of recommendations to reach this goal, by updating the education part of Astronet’s roadmap for European astronomy, established under the EU seventh framework programme.

The Diagnosis of Misconceptions in Basic Astronomy
Ana Rita Guerra, NUCLIO, Portugal.

Abstract
This study describes the development of a test to identify student’s misconceptions in basic astronomy. Researchers and teachers agree that misconceptions are a powerful obstacle to meaningful learning. Its identification is, then, an essential step to design instructional activities.

The authors reviewed the international literature in search for diagnostic tests of basic astronomy (age 12 to 16). After the identification of major categories for items, a selection of these items was adapted to Portuguese and validated by a group of teachers (content validity). Special care was taken with the quality and clarity of the images used in the test. The test suffered a few iterations on the validation process.
The final version was administered to 7th and 10th graders of 12 schools, as well to 54 teachers, in the context of an astronomy workshop for teachers. The results were consistent across different schools and grades. They illustrate that some misconceptions have a large frequency in different groups of students and even in teachers.

Education through Cultural Astronomy
Tibisay Sankatsing Nava, UNAWE/Leiden University, The Netherlands.

Abstract
Astronomy can play an important role in promoting the understanding of science. Cultural stories about the night sky, belonging to the field of cultural astronomy, can be used a stepping-stone in astronomy education. This pilot study investigates the use of cultural astronomy as a tool for education through the evaluation of a workshop developed for Universe Awareness (UNAWE). The study, conducted with 120 South African learners, is comprised of three parts: surveys, direct learning assessments and participant observations. The data was analyzed according to UNAWE’s educational program evaluation framework ‘Domains of Active Learning’. Results show that the Cultural Astronomy workshop was effective in teaching participating children about the universe. Participants were stimulated successfully in the Domains of Active Learning; they were motivated by the activities, acquired both scientific skills and knowledge about the universe and developed intercultural attitudes. These findings suggest that cultural astronomy may be successfully used as a tool for astronomy education. The research tools and results of this pilot study can be used for future research to further evaluate the use of cultural astronomy as an educational tool on a larger scale.
**Teaching Inquiry in Nigeria: the West African Summer School for Young Astronomers**

Linda Strubbe (CITA, Canada); Kelly Lepo (Univ. of Toronto, Canada); Heidi White (Univ. of Toronto, Canada); Jielai Zhang (Univ. of Toronto, Canada); Bonaventure Okere (CBSS, Nigeria); James Chibueze (NAOJ, Japan); Daniel Okoh (CBSS, Nigeria); Michael Reid (Univ. of Toronto, Canada); Lisa Hunter (ISEE, UCSC, USA).

**Abstract**

In October 2013 over 75 undergraduate science students and teachers from Nigeria and Ghana attended the week-long West African International Summer School for Young Astronomers. The school was organized by a postdoctoral fellow (the lead author) and three graduate students from the University of Toronto, along with staff from the Nigerian National Space Research and Development Agency. We designed and led activities that taught astronomy content, promoted students' self-identity as scientists, and encouraged students to think critically and figure out solutions themselves. I will discuss the innovative, inquiry-based, active learning techniques used in the school and share results from the qualitative and quantitative evaluations of student performance. I will also describe cultural differences in learning and communicating that we encountered how we can understand these to teach more inclusively at home, and ways audience-members can get involved in similar projects in the future.

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**Music of the Spheres: Whispers of the Universe, Human Sounds**

Domingos Barbosa, Instituto de Telecomunicações - Aveiro, Portugal. Isabel da Rocha, Escola Superior de Música e Artes do Espectáculo do Porto, Portugal.

**Abstract**

The Universe is full of sound: from the acoustic waves of the infant expanding Universe carrying the Big-Bang moments engraved in the Cosmic Microwave Background (CMB) to planetary aurorae "listened" by deep space probes like Cassini over Saturn.

From Nature's whispers to the Voyager Golden Record, cosmic sounds are a source of musical inspiration paving new ways to the human understanding of our Universe. We will describe the several phenomena that can be listed by radiotelescopes and deep space probes and how education and
artistic creation can benefit from the scientific "ears". A musical composition will be performed using sounds from the CMB, Venus, Uranus and Neptun along the more human Bach Goldberg variations.

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**Exploring the Frontiers of Science Education with the Support of the Inspiring Science Education Project**

Sally Reynolds, ATiT, Belgium. (responsible within the Inspiring Science Education project for European dissemination activities and pilot activities in Flanders)

**Abstract**

Inspiring Science Education is an ambitious EU supported project that is providing science teachers in Europe with access to inspirational digital resources and learning opportunities. Involving 30 partners in 15 countries, our mission is to provide opportunities for teachers to help them make science education more attractive and relevant to students’ lives and by the end of the project, partners will have set up activities in 5000 primary and secondary schools.

ISE activities range from providing interactive simulations, educational games and eScience applications to supporting extra-curricular activities, visits to science museums, access to external labs and opportunities to experiment. In Flanders for example, this school year we will be running pilot activities in collaboration with the local ESA educational office linked to the Rosetta mission to encourage teachers and students to set up their own experiments and projects linked to what will be happening in Rosetta. We are also running workshops and support sessions for teachers to help students enhance their exploration and measurement skills in the classroom with our project partner Vernier. This will include workshops on the use of video in the science classroom as a means to capture and measure natural and scientific phenomenon.

One of our main activities this year is the ISE competition which we are launching today linked to the International Year of Light. This competition aims to reward excellence amongst science teachers in their planning and realization of an inquiry based science activity or project related to the topic of light that involves teachers and schools in 2 or more countries, one of which needs to be a member of the European Union. The way this competition works is that you first need to go to our website and download a worksheet which will guide you in the set-up of your project. It will also point you towards communities and resources in the Inspiring Science Education portal that can be useful in the set up and realization of your project. You then carry out your project with your students and a teacher and
students in another country and submit your completed worksheet by the competition deadline which is 1 March. Finalists in this competition will be selected in April and will be invited to London in June for the Science on Stage event taking place where their trip will also involve visits to science museums and other interesting opportunities.

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**Out of this World Observatory Careers: Gemini Promotes Observatory Careers in Host Communities (and Beyond)**
Antonieta Garcia Ureta, Gemini Observatory, Chile.

**Abstract**
Sustaining a strong local workforce to inspire our youth and support astronomy in our local communities (in Chile and Hawai’i) is a core objective of the Gemini Observatory. To that end, Gemini’s Public Information and Outreach team has produced an innovative bilingual brochure with a companion website to make observatory (STEM) careers accessible to everyone. An assessment plan will direct future version of these materials as well as input from participants who attend this presentation. The new materials focus on careers ranging from astronomers and engineers to support staff. An attractive engaging brochure, augmented by brief, web-based video interviews of selected Gemini staff, comprise the core of the new materials. Launched in early 2014, the materials are already a core element of Gemini’s local and national outreach efforts and are being successfully integrated into teacher workshops, career days and family and classroom programming at local schools.

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**Astronomy and Society: INAF Education and Outreach Projects**
Caterina Boccato, INAF - Astronomical Observatory of Padua, Italy.

**Abstract**
The Italian National Institute for Astrophysics, which is constituted by 17 institutes all over the Country and the TNG National Observing Facility in the Canary Islands, is organized through a network of people specialized in astronomy education. This network has been funded, in 2013, by the National Ministry of Education and Research in order to develop a large project called “Astronomy and Society: Education, Outreach, and New Technologies”.

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We will present all the activities included in the project.

Among these, the realization of EDU.INAF.IT, the Italian web integrated system for the dissemination of the astronomical and astrophysical knowledge. Conforming to the classification and standardizing techniques developed by IAU, it aims to support science teachers with innovative WEB tools and interactive courses. A second activity is UNIVERSO (IN) REMOTO which is a project aimed to allow students to use professional telescopes with the Virtual-Observatory tools. Also, ASTROKIDS is a series of laboratories for children, developed by different INAF institutes, which have been collected recently in a book presented in a separate poster. Another project is the cartoon: “Giga and Stick Exploring the Universe” composed by two episodes: the first episode is about the Solar System, and the second one is about our Galaxy.

Creative and tactile Physics
Alison Alexander and Ruth Wiltsher, Science on Stage, UK.

Abstract
Creative and Tactile Physics is a hands-on collection of activities designed to help students understand physics concepts through the medium of craft. This lends itself well to situations where tactile learning is important.

Activities include:

- Making and handle a planet - learn about the properties of planets in our solar system
- A galaxy window decoration - learn about shapes of galaxies
- A particle explosion mobile - learn about what happens in accelerators
- Make a 3D picture of astronomical phenomena - sun and planets, comets, asteroids.

In different settings we have trialled some of the work of the Meet Our Neighbours Project by Lina Canas of Núcleo Interativo de Astronomia which converts the visual to tactile experience letting visually impaired students learn and explore about astronomical phenomena.
ESO Ultra HD Imagery for Educators

Babak Tafreshi, ESO & TWAN, Germany.

Abstract
During the spring of 2014, a team of four astrophotographers embarked on a pioneering expedition to capture the stunning night sky of the Chilean Atacama Desert using state-of-the-art Ultra High Definition technology. Organized by the European Southern Observatory, the team travelled to several astronomical observing sites in Chile to record high resolution images, timelapse motions, and full dome content for planetariums. Nearly all of this content is provided for free and enrich astronomy education tools world-wide. The images not only display where the observational research astronomy happens at its cutting edge, also illustrate principles of practical astronomy and stargazing, therefore besides general public, the imagery supports science communicators, from teachers and lecturers to journalists. They also display the natural looking colours and appearance of the night sky. One of the challenges of our team was to deliver images while avoiding montage, over-cooked processing, or altering the natural view and colours. Some of these images can be used as a reference for night sky natural colors for educators and photographers. The adventurous stories behind some of these images and the technical aspects are another dimension that enables educators to better evaluate and communicate with our released content.

From Archaeoastronomy to Supernovae

Michel and Suzanne Faye, Hands-on Universe, France.

Abstract
With Stellarium (virtual planetarium), we visit ancient times astronomy all over the world, meet ancient supernovae on West America rocks, or in Asian ancient texts. So, we present supernovae eminent, till nowadays observations.
Research Projects for High School Students
Ido Bareket, Bareket Observatory, Israel.

Abstract
In this presentation we present a study examining how can high school students in Israel (K12) perform exploration work remotely, via the Internet, on astronomy and earth sciences through the Bareket observatory's Internet remote Telescope. The projects involved high level mathematics, computer science and physics.

A Touch of the Universe
Amelia Ortiz Gil, Astronomical Observatory of the University of Valencia, Spain. Lina Canas, NUCLIO, Portugal.

Abstract
“A Touch of The Universe” non-profit project has built 30 sets of tactile astronomy kits addressed to children with both normal or vision impairments. The kits have been distributed among educators and teachers in underdeveloped countries in Americas, Asia and Africa.

ASAMI: After School Science and Math Integration (with GHOU)
Jenifer Perazzo, UC Berkeley, Carl Pennypacker, UC Berkeley, USA.

Abstract
Over the past two years, we have developed a successful after-school program that integrates math and science, based on GHOU materials -- "ASAMI: After School Science and Math Integration," for students in California where Spanish is the language spoken in the home. Such students are doubly challenged in their science and math acquisition, as they must learn a new spoken and written language and the language of math and science. We have found that our after school program, which meets for 2 hours twice a week after school, enables students to learn math from the "Common Core" for pre-algebra for students of age 10 to 14 years old. Students who took pre- and post-tests improved their test scores by 45% after ASAMI. We want to share our program and see it develop as part of the GHOU offering.
Tanzania -- A Centre for Science Education and Observatory
Chuck Ruehle, Telescopes to Tanzania, USA, Sue Ruehle, Telescopes to Tanzania, USA.

Abstract
The Center for Science Education and Observatory will become a Tanzanian hub that will have a long-lasting impact nationwide by training teachers, offering hands-on laboratories (including an astronomical observatory), and providing quality educational resources.
The gateway to the development of Tanzania's own STEM curriculum has been opened, and the groundwork has been laid to begin the next critical phase of development.
The presentation will highlight the work of the past year and point to the next steps in the Centre's development.

Authentic Science in the Classroom
Auriol Heary, University of Western Australia, Australia, David Blair, University of Western Australia, Australia, Grady Venville, University of Western Australia, Australia, David Coward, University of Western Australia, Australia.

Abstract
This paper examines the impact of authentic science activities on student knowledge and attitudes. Included is student participation in international projects using instruments such as the EarthKam on the International Space Station and the Lunar Orbiter. It uses optical astronomy and imaging as a core research theme.
Modern, automated telescopes and imaging software has made transient object searches a valuable addition to research based work conducted by professional astronomers. Public outreach programmes initiated by significant Space Research organisations such as NASA are a valuable addition to authentic research activities conducted by students.
Finding new transient objects is an exciting field of modern research where discoveries can have real life
implications, such as discovering potentially hazardous near Earth asteroids. Asteroid research and access to instruments such as EarthKam, have provided opportunities to use transient object searches and imaging as tools for authentic science in the classroom. My research follows the knowledge demonstrated and attitude of students aged eleven to thirteen in an Australian school, as they use research grade instruments to study known asteroids, search for ones yet to be discovered and take and analyse images of the Earth from space then share their findings with students from around the world.

+Ciência - Educational Activities Development
Pedro, Borges da Silva, +Ciência, Portugal; Paula Costa Lima, +Ciência, Portugal.

Abstract
Last year, +Ciência launched the educational activities for schools and institutions. Solar and Nocturnal observations were the main ones, but as we well know, so very often this type of activities are presented only to be an observation, and we planned and wanted to take them further. Curriculum enrichment activities can be a powerful tool, one that stimulates students to try to put into practice all those “dull” topics learned at school. But in order for this concept to be successful it must please both students and teachers. For this and based on our expertise has a tutoring center and outreach experience, +Ciência adapted and created a number of activities having Astronomy as a primary subject but deeply related to the school curriculum. Each activity is designed and aimed for a certain scholar grade. Narrowing the broadness for the recommended age we rise the efficiency of the activity since the subjects referred in it are still well reminded by the students.

The Lost World... of starry night!
José Gonçalves, Escola E.B. 2,3 de Amarante, Portugal.

Abstract
Light Pollution is something that citizens never think about handful consequences at many levels. In this scenario, more than 200 students from different grades experienced some consequences of this kind of pollution. A map was built with results about Amarante region and was communicated to school’s community.
Science Club and Astronomy
Maria Peto, Szekely Miko High School, Romania.

Abstract
My presentation is based on few school projects and experiments which I used during the last school years at Science Club and practical outdoor activities, to familiarize my students with Astronomy and Cosmology. The Romanian Physics curriculum does not include Astronomy or lessons linked to these topics. When the students ask questions like: “How can I observe a Black Hole? Is there any method to study the exoplanets?, How could we explain the birth of the craters on the Moon or other satellites” I organize different workshops, observations or projects activities. In this context my regularly Science Club activities are “Study of the Sunspots”, How could we explain the formation of the craters on the Moon?, Measuring the diameter of the Sun, Measuring the speed of the light, Measuring the atmospheric parameters with CanSat device.
During these projects the students have possibilities to use the acquired physics knowledge (law of conservations, motions laws, etc.) to explain the movements or evolution of the Solar system objects or galaxies.

Astronomy Education for Primary School
Cristina Maria Sá, Agrupamento de Escolas do Castelo da Maia, Portugal, Lucília Santos, Departamento de Física e Cidttf - Universidade de Aveiro, Portugal.

Abstract
This study presents a research based on Astronomy education for primary school. A didactic sequence has been established to the learning objectives of the 3rd and 4th years of schooling and put into practice during a professional development course with in-service teachers.
A quasi-experimental study was designed and data collected through questionnaire and reflective portfolio. The analysis performed shows that teachers of the experimental group achieved a significant improvement on scientific knowledge through the practice of hands-on activities.
i-Can, the Constellation Camera System for Education

Naoki Matsumoto, Keio Senior High School, Japan. Takehiko Satoh, Institute of Space and Astronautical Science/JAXA, Japan.

Abstract

We developed the Internet astronomical observatory. It could be operated via an internet browser from anywhere in anytime. We used this expertise for development a remote constellation camera system. And we placed these cameras plural points in the world. So, we named it i-Can as abbreviation of "Interactive Camera Network". The i-Can realise the class using real-time constellation in daytime without being influenced by the weather. I introduce its construction and educational practice in the elementary school using i-Can.
**Hands-On Resources**

Leonor Cabral and Paula Furtado, NUCLIO, Portugal.

**Abstract**

Our goal is to work with children from 4 to 13 years old, helping them to acquire scientific knowledge of the world around them in exciting and joyful way, broadening children’s horizons and showing them how important the environmental preservation of the earth and sky is.

Developing hands-on activities, story tales, sky simulations, solar observations are some examples of the built up activities.

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**astroEDU**


**Abstract**

“There are many sources of educational resources for astronomy across the world. The quality of these resources is highly variable making the effectiveness to the end-user an unknown quantity. They are not maintained or updated regularly and have a limited content review. This lack of support for astronomy educational resources discourages teachers to use astronomy as a tool in classrooms. At the same time teachers struggle to find the quality and curriculum relevant resources to support the science teaching at schools. To address these issues and more, astroEDU project follows a peer-reviewed process similar to what scholarly articles are based on. Content created are open-access in order to make the activities accessible to educators around the world while letting them discover, review, distribute and remix the activities.

Propose to host a workshop for teachers and educators at the meeting on creating peer-reviewed open access content using enquiry-based learning methods. The content produced during the workshop will be published on the astroEDU platform after the peer-review process. They will also be shared with other repositories such as OER, Scientix and TES.
**Hands-on Universe France Activities**

Michel and Suzanne Faye, Hands-on Universe, France.

**Abstract**

A panel of workshop, from elementary schools to high schools:

- Shadows and lights in the Universe
- Measuring time, from Mesopotamia to nowadays
- Exoplanets (spectrometry, Doppler effects and photométry)
- HR Diagram (the colours of stars)
- Black hole, dark matter, dark energy
- Precession of equinoxes
- Flags and astronomy
- Van Gogh and the stars

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**From quarks to the universe through the “Big Ideas of Science”. – Introducing interdisciplinary activities for the science classroom through a federation of online labs.**

Eleftheria Tsourlidaki, Ellinogermaniki Agogi, Greece.

**Abstract**

The workshop aims to introduce to participants the “Big Ideas of Science” (BI) concept and demonstrate ways through the use of online labs of interweaving different science subject domains in everyday teaching. Such an approach will help their students acquire a better perspective on the connection between different natural phenomena and laws.

In the beginning, there will be a brainstorming session among participants so as to record their own perspective on what are the BI and compare them to those existing in bibliography. Afterwards, example activities that deploy the use of online labs will be presented to participants to show how various science topics can be connected on the base of a certain BI. Teachers participating in the workshop will be provided with scenarios of use that will allow them to enhance their everyday teaching and increase students’ engagement in science related activities.
Tactile Astronomy

Lina Canas, NUCLIO, Portugal; Amelia Ortiz-Gil, Astronomical Observatory of Valencia, Spain; Alison Alexander and Ruth Wiltsher, Science on Stage, UK; Isabel Borges, Science on Stage, Portugal.

Abstract

Astronomy is a visual science. Galileo put brush to paper to capture his view of the Moon through a small telescope which revolutionised the human enquiry mind. However, due to nature of the subject, many people with visual impairment miss the opportunity to experience the beauty of the universe. Transforming this highly visualised science into a tactile experience is a challenge. These challenges are met through recent programmes which aim on bringing a tactile astronomy experience to the community. The workshop will explore the resources and discuss to develop further.
Meet our Neighbours! - a tactile astronomy experience
Lina Canas, NUCLIO - Núcleo Interativo de Astronomia, Portugal.

The ESERO project in Belgium
R. Alvarez, Royal Observatory of Belgium, Belgium.

Framework of Astronomy Literacy Goals
Erik Arends, Universe Awareness (Leiden Observatory), The Netherlands.

Astronomy education in a forest school

ESA resources in the Physics classroom
Pedro Mourão, Colégio Júlio Dinis, Portugal.

Astronomy and Society: INAF Education and Outreach Projects
Caterina Boccato, INAF - Astronomical Observatory of Padua, Italy  INAF POE Network, Italy.

Rediscover the Astronomy: A New Window to the Sky the Cerrado
Willian Garcias de Assunção, Thiago Oliveira Lima, Reidner Barbosa Ramos, Alessandro Martins - Universidade Federal de Goiás, Brazil.

Vamos Aprender - Jogo de Astronomia
Teresa Paiva, Salesianos de Lisboa. Oficinas de S. José, Portugal.

High School Students Research Projects
Ido Bareket, Bareket Observatory, Israel.

From Mythology to Astronomy: an interdisciplinary educational project
Antonino La Barbera, Valentina La Parola, Teresa Mineo INAF-Istituto di Astrofisica Spaziale e Fisica Cosmica di Palermo, Italy; Antonella Balistreri, Museo Regionale di Palazzo Mirto – Palermo, Italy.
“As Estrelas na Ferreira” - Astronomy as a link between School and Family
Cristina Pinho; Elsa Ferreira; Fernanda Vieira; Laura Jardim; Escola Secundaria Ferreira Dias, Agualva, Sintra, Portugal.

The European Projects by Portuguese Schools
José Gonçalves, NUCLIO, Portugal.

Space Scoop: Bringing News from Across the Universe to Children Around the World
Sarah Eve Roberts, Cardiff University/ UNAWE, UK.

Universe in the Classroom
Sarah Eve Roberts, Cardiff University/ UNAWE, UK.
Astronomy EDUcation Alliance Meeting

High Engagement and Deep Learning of Math, Science and Technology through Astronomy Education

http://handsonuniverse.org/astroeducation