

SPORE* SERIES WINNER

Astronomical Perspectives for Young Children

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Many of us have experienced a moment when, mesmerized by the beauty of a night sky, we reflected upon life, here and elsewhere. The realization of our place in the universe is humbling, but it is also inspiring.

Universe Awareness (UNAWE) is an astronomy education and outreach program targeting young children, from 4 to 10 years old, in underprivileged environments. At this age, children are developing their cultural landscape and value systems, which serve as references as they grow and learn. The rationale behind UNAWE is that the unique perspective brought by astronomy, e.g., seeing Earth from space, without real borders between countries, helps young children develop the skills and values that will help them create a better future for themselves.

Since 2005, UNAWE has grown to involve more than 500 volunteers, organizations, and governments in 40 countries. UNAWE grew most during the International Year of Astronomy (IYA) in 2009 and is now an important ingredient of the International Astronomical Union's decadal development strategy (1).

Educational resources, generously contributed by the network of volunteers to UNAWE, have been collected and published (www.unawe.org/). Many UNAWE members have contributed translations, which are then featured on the site. Quality control comes through an automatic peer adoption process. The resources are checked for scientific accuracy by qualified astronomers before they are posted online, where the most useful resources naturally become the most used resources. One of the most successful activities UNAWE features is the "Deadly Moons" workshop.

Deadly Moons is a 1-hour interactive workshop that teaches students about our Moon and the other exotic moons in our solar system. Deadly Moons is immediately made



Illuminating understanding. A drawing of Mimas, one of Saturn's moons, by Eden Munroe, age 12, of Ashbourne Irish Girl Guides, Dublin, during Discover Science and Engineering's Science Week 2010.

relevant by its title, as many children in Ireland use the street phrase "That's deadly!" in everyday life about things that impress them totally. On UNAWE, the local nature of this expression is described, and educators in other countries either teach their students about the Irish expression or use the equivalent colloquial expression in their own language. Students learn about moon phases, active moons, quiet moons, Galilean moons, moon exploration, and moon terminology. When they have absorbed enough information about these moons they are invited to vote in a vocal way to indicate which moons they like the best. The group then produces drawings of their favorite moons.

Thousands of observational drawings have been produced by participants of Deadly Moons (see the figures). Some of these drawings were exhibited as part of the IYA, both at the opening celebrations in Paris and at the international astronomical sketching exhibition in Ireland. Additionally, many schools and libraries have held exhibitions of the work produced for the local communities to see.

Crowd-sourced efforts and online educational resources are able to multiply the impact of astronomy outreach and education.

Each year, an increasing number of schools in Ireland have used Deadly Moons toward their Discover Primary Science award. This award acknowledges the efforts of primary school children and teachers who have shown an increased knowledge of science and math. Evaluations revealed retention of information; many of the children were unaware of other moons before the workshop but could remember the names of several after their participation.

Deadly Moons has spawned several other successful workshops using the same format, including The Sun's Massive, about Sun terminology and robotic solar exploration, and Rapid Rockets and Wicked Robots, which is a history, through drawing, of space exploration. Additionally, Deadly Moons now has a follow-up moon drawing workshop that uses richly colored images from the U.S. National Aeronautics and Space Administration (NASA) lunar explorers. The new workshop was the inspiration behind the paintings that some Irish children produced for OPTICKS 2011, a live science and art audiovisual performance using radio waves between Earth and the Moon (www.ustream.tv/recorded/13911581).

In general, UNAWE activities come from places where financial means are often scarce and are therefore full of good ideas at low cost or no cost (2). The science is not shrouded in high-tech imagery that may distract children, and the hands-on nature of the activities ensures real learning. They are also locally relevant, as ideas are contributed by educators close to the children, the resources convey the right message, children identify with the characters featured in the stories, and they are familiar with the real-life examples shown.

UNAWE is not just about sharing resources. Astronomical events present the perfect opportunity to connect children and educators worldwide. Two classrooms, separated by the Atlantic Ocean, are preparing for a lunar eclipse. They understand that Earth is round and that while it is day in some places, it is night in others. In rural South Africa, it is early morning. Pupils have spent an exciting sleepover at the school with an astronomy workshop and star-gazing the evening before. Now, at 4 a.m., they are awake and ready to

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view our eclipsed Moon. Across the globe in Bermuda, it is evening after an unusual school day in which UNawe volunteers have come to talk about the Sun, the stars, and the Moon. As the eclipse draws near, an Internet connection is established between the schools. “Good morning!” wish the South African learners. “Good evening!” retort the Bermudans, and the children are left to smile at the time difference and chat among themselves. Children strike up an immediate friendship and start realizing the differences in their lives: “Here, water is a problem, we do not always have enough,” says one South African pupil. “Water is a problem here too, but we are trying to keep our houses dry” says his Bermudan friend, and both laugh at the seemingly absurd situation. Suddenly, one child runs into the Bermudan classroom. “The Moon has gone red!” she shouts. All abandon the computers and run outside, in both Ber-

muda and South Africa.

Events like this one would not be possible without a strong network of dedicated volunteers—the true strength of UNawe. The idea is simple and powerful: Teachers, students, parents, children, and other people involved in the education of the youngest generation understand easily how astronomy inspires children and take ownership of the program. UNawe is a bottom-up program relying on local ownership of its philosophy. Living in a poor rural area of



Deadly Moons Workshop at Wicklow Arts Festival.

the world with a privileged access to the night sky but no one to explain it is a different challenge from growing up in a city where teachers struggle to impart concepts only seen through television screens or advertising. Rural settings are rich in natural beauty. Urban environments may have more infrastructure, but light pollution is a real hurdle for astronomy. Only those in touch with the children know what specific conditions they are learning and living in.

UNawe also connects its volunteers through regular workshops, enabling them to exchange ideas and best practices. At one such meeting, primary school teachers from Spain solved the problem of an Indian educational nongovernmental organization trying to explain why days grow shorter or longer at different times of the year with a model easy enough for a 6-year-old to understand. Another teacher had the simple idea of covering a ball with aluminum foil to demonstrate that the Moon reflects sunlight and does not emit its own. Venezuelan colleagues showed how to make a spiral galaxy magically appear by using sand and water in a flat-bottomed glass bowl on a projector. Such exchanges help the teachers build confidence in their ability to teach

scientific topics.

Until 2010, the coordination of UNawe was funded by a seed grant from the Dutch Ministry of Education, Science, and Culture. Since then, UNawe has been awarded a European grant of almost €2 million (U.S. \$2.87 million), allocated to create and implement a professional development program for primary school teachers in six countries. The resource Web site is currently being redeveloped as part of the European Union-funded program. Professional expertise will be involved in evaluating the resources, and although the site will continue to welcome educational resources from all our partners, it will also offer new resources, developed professionally.

Children around the world are different, and yet they share curiosity and an appetite for learning and for understanding the world around them and their place in it. UNawe volunteers bring the unique perspective of astronomy to young children, giving them a chance to appreciate the scale and beauty of the universe, empowering them to think independently, and bringing them closer to each other.

References and Notes

1. International Astronomical Union, Astronomy for the Developing World: Strategic Plan 2010–2020; http://iau.org/static/education/strategicplan_091001.pdf.
2. See also <http://www.arvindguptatoys.com/> for examples of excellent hands-on low- or no-cost science toys.
3. This work would not have been possible without the support of the Ministry of Education, Science, and Culture of the Netherlands and the visionary initiative of George Miley, founder of UNawe. Most of all, C.J.O.-G. is grateful to the network of 500+ volunteers worldwide whose generous efforts and unique contributions enabled UNawe to grow into a reputable community of practice. D.K. thanks the Dublin Institute of Advanced Studies, Blackrock Castle Observatory, and Dublin City Libraries.

About the Authors



Carolina Ödman-Govender studied physics engineering at the Swiss Federal Institute of Technology in Lausanne before completing a Ph.D. in theoretical cosmology at the University of Cambridge in the United

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Deirdre Kelleghan lives in Ireland where she is both an amateur astronomer and an artist with a passion for experimentation in lunar, solar, and deep-sky sketching. She is an avid informal educator who develops drawing workshops and talks for children and adults. As an amateur astronomer, Deirdre is vice chair of the Irish Federation of Astronomical Societies, Irish representative of Astronomers without Borders, and a member of Jet Propulsion Laboratory–NASA’s Saturn observation campaign. She is coauthor of *Sketching the Moon: An Astronomical Artists’ Guide* (R. Handy, D. Kelleghan, T. McCagne, E. Rix, S. Russell, Springer, New York, forthcoming 2011).

