

Universe Awareness: Inspiring young children around the world

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Abstract. Universe Awareness (UNAW) has over three years of experience enthusing young children with the scale and beauty of the Universe. UNAW is an outreach programme with a strong social vision aiming at broadening children's minds, awakening their curiosity in science and stimulating global citizenship. UNAW uses the inspirational aspects of astronomy to instil a culture of peace and tolerance. We present the main principles of the programme, describe how it functions as a community-driven organisation and share some of the UNAW experience. We describe projects and opportunities for IYA2009 and the future of the global programme.

Keywords. Education, astronomy for development, culture, early childhood development.

1. Introduction

The rôle of astronomy in society and culture is a fantastic subject of study. Astronomical knowledge and references can be found in art, architecture, technology, religion and many other aspects of life and have been for as long as we can remember. The study of astronomy in society teaches us a great deal about ourselves as a thinking species. Perhaps for that reason it is also a great force to be harnessed for the benefit of future generations. This is what Universe Awareness (UNAW) is trying to achieve.

UNAW is a programme that reaches out to very young children starting at age 4 and enthuses them with the most inspiring aspects of astronomy. Some children have more opportunities than others so we try to first reach those who have the least chance in life to be exposed to the beauty of the universe. That often means children in underprivileged environments. The goals of this initiative are to broaden children's minds, to awaken and maintain their insatiable curiosity in the natural world, to demonstrate the power of rational and critical thought and to stimulate their tolerance and world citizenship.

Early childhood education and development of good quality is a worldwide necessity†. UNAW is a programme with social aims that uses astronomy to contribute to this need.

2. Focus on 4 – 10 years old children

Figure 1 shows the fraction of school pupils exposed to astronomy as a function of age. The two lines represent estimates from data from 24 European countries‡. On top of the lines, various stages of the development of the child have been colour-coded (Shonkoff & Phillips 2000)¶.

† World Bank report (2007) *Early Child Development From Measurement to Action. A Priority for Growth and Equity*, online at <http://go.worldbank.org/34V01B5QA0>

‡ ASTRONET Infrastructure Roadmap (2008), available online at <http://www.astronet-eu.org/IMG/pdf/Astronet-Book.pdf>

¶ <http://en.wikipedia.org/wiki/Child.development.stages>

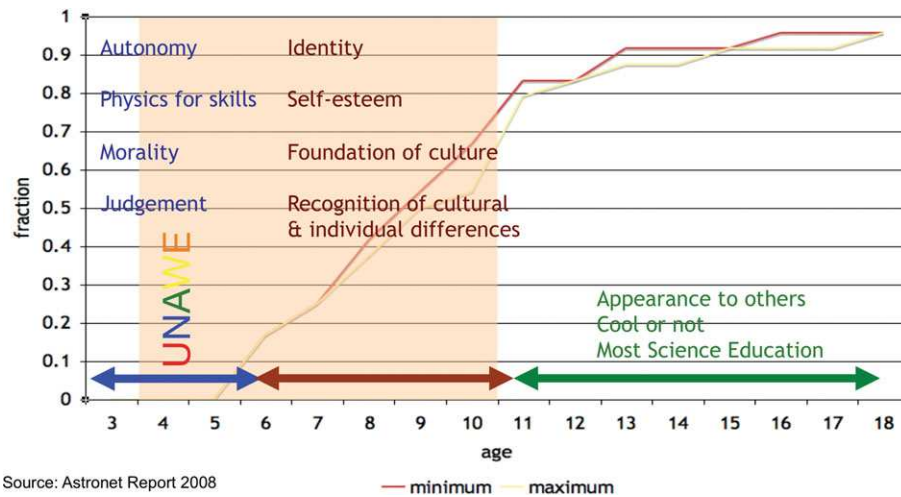


Figure 1. Child development stages superimposed on the fraction of pupils exposed to astronomy at school as a function of age.

Children learn to interact with their environment very young. They learn physics instinctively for the development of their motor skills; sit up, stand up, walk, hold objects, eat and drink independently. They learn to become autonomous. This is also the age at which they develop a sense of right and wrong. This is the first stage of morality and judgement. A little later they start to define their identity. They begin to consider themselves as an individual in a society, a person in a bigger world. This is the stage at which they start developing complex interactions with other people, not only the environment. Until the pre-teenage years, this identity gains complexity and refinement. The foundations of the cultural identity are laid. This is the reference frame that remains with us throughout our life. With the perception of the cultural identity comes an understanding of differences (gender, etc.) and the sense of belonging to social groups.

Later, when most science education programmes start, the identity factor becomes even more important. Peer pressure and group dynamics influence children's learning hugely. An unfortunate consequence of this is that the success of a science education programme depends on a judgement; science is cool or not, and that decision depends on a complex web of factors, not just the quality of educational resources.

The UNAWA programmes try to reach children at an age where their value system and identity is formed. We believe that the inspirational aspects of astronomy and the universe can bring new perspectives that will influence children's development beneficially.

3. Astronomy – a special tool

3.1. Science

Science is not about knowing facts, names or any kind of answers by heart, nor is it about being right or wrong. Science is about questioning one's environment in an effort to try to understand it. Children's natural curiosity makes them ask such questions and UNAWA activities encourage this. Asking questions lead to discoveries about the world. Discovering something and a feeling of ownership of each finding results in an enthusiasm for the topic and children share their discovery naturally with their parents, educators and other children. This eagerness can be nurtured to stimulate further questions and further exploration. Science should be a gratifying journey of discovery.



Figure 2. This young boy enthusiastically explains the movements of the Earth and Moon. UNAWE Venezuela - CIDA.

3.2. *Technology*

Technology is found everywhere: communication, entertainment, education, health, agriculture, business, etc. It is at the heart of development. Technology also enables us to break new ground in human knowledge. Space technology in particular lets us break the frontiers of human exploration. Technology opens the door to a wealth of future possibilities. UNAWE wishes to give underprivileged children a chance to believe in a future of opportunities and bring technology within the realm of the achievable. An increasing number of developing nations are entering the previously very select group of space-faring nations. As this democratisation of space occurs, all children around the whole world should feel part of the “space generation”.



Figure 3. These two children have built a model of the Simón Bolívar satellite, a technological breakthrough for Venezuela and a source of pride that unites its very diverse population. UNAWE Venezuela.

3.3. *Culture*

Astronomy has always been present in culture. The human and social aspects of astronomy play a pivotal role when science is presented as an alternative to certain superstitions. We connect with superstitions emotionally (irrationally). It is not possible to “replace” superstitions with only modern science as it is too dry and leaves little room for

emotional attachment. We try to contextualise the origins of myths and mythologies with the origins of modern astronomy. Belonging to a culture and a group, children will take ownership of their astronomical heritage and fill this emotional gap, especially when astronomical history remain visible in modern astronomy, e.g. through names of stars still in use today.

But culture is also a means of expression and astronomy lends itself to art and creation and in the implementation of the programme, creative activities, individual and in groups, are strongly recommended and encouraged (Lee & Johnson 1993).



Figure 4. Capture of an animation film made by school children in Tunisia. UNAWE Tunisia – Sfax children’s club.



Figure 5. Capture of an animation film made by final year multimedia students and illustrating an indigenous astronomical legend. UNAWE Venezuela – CIDA.

3.4. *Hands-on Minds on*

The importance of hands-on activities in stimulating children’s independent thought and reasoning is widely recognised (Rocard *et al.* 2007).

As children are exposed to new concepts and thoughts, hands-on activities play an essential role in making sense of the newly acquired knowledge. Taking the time to reflect upon it and to retell it through other means of expression (models, drawings, etc.)

enables children's understanding to deepen and become more elaborate. When working in groups, children also exchange interpretations of the new information and learn to communicate it and work together to make sense of it.



Figure 6. Children are busy reflecting on things learnt in Indonesia. UNAWE Indonesia.

3.5. *Excitement*

Astronomy has the enormous advantage over most scientific disciplines in that it produces some of the most beautiful images humanity has ever captured. From the colourful nebulae to the first real photograph of planet Earth, these images capture our imagination, and those of the children. The most extreme conditions are found in space. Astronomical temperatures, explosions, distances, sizes and timescales challenge our understanding and stimulates our imagination. Above all, astronomy gives us perspective. In the words of Carl Sagan:

“National boundaries are not evidenced when we view the earth from space. Fanatic ethnic or religious or national identifications are a little difficult to support when we see our planet as a fragile, blue crescent fading to become an inconspicuous point of light against the bastion and citadel of the stars.”

4. A child's world

UNAWE tries to stimulate curiosity and tolerance among children. As the programme contributes to their cognitive development, it empowers them with critical and rational thinking. If we are going to bring this to young children, it will affect a number of people around them. UNAWE strives to involve all those present in a child's world.

4.1. *Parents & guardians*

It is crucial to involve the people in charge of bringing up children. More than approve of UNAWE, in certain cases they are directly engaged in the programme. Parents are consumers of culture. They decide whether to bring children to a mall or to a planetarium. Coincidentally, they are also the tax payers who might be more willing to see government spending on science and technology if their children are enthusiastic about it.



Figure 7. This group of neo-literate women discuss astronomy and astrology at self-help group meetings, setting the example to children that such topics can be discussed and debated and should not be simply accepted. UNAWE India – TNSF.

4.2. Educators & teachers

Teachers often harbour reservations against teaching science because it has a bad reputation. It is most often taught from a book with no connection to real life. The image of science can be roughly generalised as being boring, not relevant to everyday life, difficult and about knowing right answers. Since, “*teachers are the cornerstone of any renewal of science education*” (Rocard *et al.* 2007). There is a strong need to correct that perception, particularly among educators and teachers who will transmit either their enthusiasm or their discomfort with the study of the natural world.

In order to achieve this, UNAWE partners carry out frequent teacher training programmes in astronomy. The hope is that this will empower teachers to talk about astronomy with confidence and enthusiasm and to show them the relevance of science in every day life. One particular aspect of this effort is the tackling of common misconceptions. It is important not to look down on those who have learnt these misconceptions but to empower them to reason for themselves and come to their own logical conclusions.

4.3. Older children

Young children look up to their older peers. They follow them sometimes blindly. If we involve the older children in the delivery of UNAWE programmes, they take ownership of the field and this contributes directly to building their scientific culture. We never learn something as well as when we teach it.

4.4. Peers

Children interact with each other. This exchange is very important as it does not take place in a teacher-learner relationship. Children can argue among themselves and have complex conversations. These conversations stimulate their critical thinking and helps them reach their own conclusions. This habit will hopefully stay with them for life.

When UNAWE brings astronomy and science to children of that young age, the programme also hopes to preempt the social preconceptions such as “*science is not for girls and only for rich countries*”. The idea is that if science becomes part of children’s cultural



Figure 8. Teacher training session at the Science City in Tunis.
UNAWT Tunisia – Science City.



Figure 9. The learners of this high-school class have built a number of electrified models of the Solar System to give to primary schools.

landscape before they encounter such judgements, then their natural cutriosity remains alive.

5. UNAWT: a global community

5.1. *Crossing borders*

The number of countries involved in UNAWT has grown steadily since 2005. The global UNAWT community has members in over 30 countries, partly thanks UNAWT's status as IYA2009 cornerstone project.

UNAWT is a bottom-up programme at heart. When someone expresses interest in joining Universe Awareness, the default response is "Welcome!". All our resources are made available online and we welcome any additions and feedback. The programme benefits from the energy and enthusiasm of a number of champions in many regions of the world.



Figure 10. Children in Bermuda and in South Africa celebrated a total lunar eclipse together in 2008. The experience was “wonderful” in their own words. More information on the event: <http://www.unawe.org/eclipse2008>.

We also maximise working interfaces with existing programmes so as to not double the infrastructure and ensure that everyone benefits from everyone else’s experience. This has led to a number of fruitful collaborations with national and international organisations and even the national support of education or science ministries in certain countries.

5.2. *Why join UNAWE*

Two innovations come with joining UNAWE. Firstly we reach out to very young children and secondly we start by trying to reach those who would not normally be reached by such programmes: underprivileged children. The expertise of our network enables people who have no experience with the youngest children to start working with this gratifying age group. Educational materials and activities are designed with the cost in mind so that a number of low-cost or no-cost activities can easily be carried out.

To make things easier we have prepared a toolkit with templates for project planning, a website, letters, etc. that can be downloaded and should help people set up their programme[†].

Another innovation of UNAWE is the use of astronomy for social good (Feder 2007). Indeed, all astronomers, amateurs and professional alike, can easily express how the perspective we reach from knowing our place on a small planet in a grandiose universe brings feelings of peace. To cite a non-astronomer (Hari 2008):

“You can imagine this for yourself, friend, flying home and seeing your homeland below in points of fire. Whatever warrior blood comes to you from your ancestors would be working inside you.

Yet, perhaps because I had already seen something of the large world, it was not so simple as that; I was indeed observing from this altitude. I counted among my friends the people of many tribes and many races, and this makes a difference in our hearts. I counted also among my acquaintances Jane Eyre, Long John Silver and Oliver Twist.

Altitude itself is a powerful thing. When travelers are in space, looking at your small planet from a distance where borders and flags cannot be seen or imagined, this also, I am told, bends one toward a peaceful view. That is what I wanted, really, just peace. I was sad and anxious for my people but not angry.”

The UNAWE global community is also a platform for dialogue across disciplines. We count partners from the following professional backgrounds: Astronomers, Teachers,

[†] This toolkit is freely available on our website at <http://www.unawe.org/join>

Students, Education and Outreach specialists, Early Childhood Development specialists, Media, Creative artists, NGOs specialising in development, Astronomy and Space organisations (Intergovernmental organisations, Amateur Astronomers, IYA2009 Cornerstone projects, etc.)

5.3. *An online database of educational materials*

Universe Awareness proposes a number of activities and materials for its programmes. They are all made available online for free on a dedicated website: <http://www.unawe.org/materials>. An accompanying website with online tools and widgets enables teachers to explore phenomena dynamically and to calculate various things on the spot, e.g. learners' weights on other planets, etc. Many of the education resources comprise an element of evaluation which is articulated around the goals of UNAWE, that is children's attitudes, enjoyment and understanding, rather than on the retention of information. The materials evolve based on the feedback and improvements from the users. This form of crowd-sourcing education ensures that the activities are feasible, relevant, and of good quality. Moreover a number of our partners are translating these activities and resources, which are then published online again. In order to ensure that everyone benefits from the network's collective experience, the website features a section called "Best Practice". UNAWE is based on an open-source model where all the resources are free to use, adapt, and improve for the benefit of all.

6. Conclusion

The realisation of our place in the universe is a wonderful experience that brings us to a peaceful contemplation of ourselves and of our immediate surroundings. With an ever-renewed sense of thrill and excitement, it puts every ill feeling and bothersome worry into perspective. Universe Awareness (UNAWE) aims to inspire very young children with this experience, through the scale and beauty of the universe.

The motivation behind this simple idea is that in today's world of divides, children in the most underprivileged environments are vulnerable to extremism and dogma that the realisation described above can help counter. With goals of broadening children's minds, stimulating their natural curiosity in science, empowering them with independent thinking and connecting them with other children throughout the world, the hope is that today's children will grow up to become tomorrow's tolerant and open-minded adults with confidence to think critically and rationally: true world citizens. We believe that astronomy is an outstanding ambassador to realise this objective.

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