



“I do and I understand”

The need to research public understanding of astronomy

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Public Understanding of Science is today an established concept. There is even, since 1992, a scientific journal with this name. The concept is usually referred to as PUS.

Bauer (2009) has given a 3-fold definition of PUS:

- “Debunking of superstitions, half-knowledge, complete and utter ignorance, misunderstanding and mumbo-jumbo, and virulent memes that give rise to anti-science.”
- PUS is to “improve science literacy, to mobilize favorable attitudes in support of science and new technology, to increase interest in science among young people and other segments of society, and to intensify public’s engagement with science in general and for the greater good of society.”
- “PUS considers common sense as an asset” and PUS research should “chart out the public controversies arising from new developments and in different regions of the world” exemplified by “the impact of the climate of opinion on knowledge production.”

During the planning of Sweden’s first science center, The Futures’ Museum with Kosmorama Space Theater, I gave seven reasons for creating a science center (Broman 1984, slightly revised 2004):

- Give an insight that science is understandable.
- Awaken curiosity.
- Give people the courage to experiment.
- Facilitate public understanding of science.
- Provide preparedness to withstand superstition and pseudoscience.

- Amuse and entertain.
- Provide aesthetic experiences.

Underlying the statements is the notion that PUS is important, which scientists happily believe, and I of course agree, but it is not as simple as that. There are so many different sciences (which, in turn, are divided into many disciplines). A rather popular notion is that “science” is that same as “natural sciences,” but that is not the case.

Again citing Bauer, science also “includes engineering and medicine, the social sciences and humanities, old and new disciplines with clear boundaries, but also...fuzzy transdisciplinary techno-sciences.” But it may be the case that the public does not need to understand all the different disciplines equally; some are more important than others.

Identify target groups

It is also important to identify target groups, since some may be more important than others. Loosely-defined target groups frequently mentioned are young people (in the world of science centers, this is often restricted to the “7-11 group” of elementary school children), voting adults, and decision makers. Other interesting group may include teenagers, refugees, religious fundamentalists, senior citizens, and young and old people living in developing countries, just to name a few.

It is also important to identify groups of science communicators. As an example, the European Science Communication Network ESCOnet, 2005-8 developed and conducted a series of workshops on science communi-

cation training aimed at young post-doc researchers (Miller, Fahy and The ESCOnet Team 2009).

Since astronomy and solar energy are two of my main interests, I have decided to investigate two sub-sets of PUS, public understanding of astronomy (PUA) and public understanding of renewable energy (PURE). The remainder of this article attempts to give a starting point of a research project on PUA.

The main questions are “is PUA important?” and, if the answer is yes, “how could PUA be achieved, and which means are useful?”

The importance of understanding

There are several reasons why public understanding of astronomy might be important:

The Earth is a lonely planet in a vast space, not as crowded as the impression one gets from science fiction movies. For humans to move from a destroyed Earth to another hospitable planet is just impossible.

The Earth is a planet alive with a dead sister and a dead brother. Venus is too hot for life due to too much greenhouse gas, while Mars is too cold due to too little.

Our universe is approximately 13.5 billion years old; the Earth, 4.5 billion years old; and life on Earth, 3.5 billion years old, in sharp disagreement with the holy books of the Abrahamic religions.

Astronomy is a very fascinating science, much more so than the superstition astrology.

A reasonable conclusion is that public understanding of astronomy is important. An

important task of a research project on PUA would be to identify pros and cons in this respect. There are also several attendant questions: What do professionals—researchers, planetarians, teachers—say? How interested is the public—in astronomy and different target groups—in astronomy, and what do they already know? Which astronomic and cosmologic disciplines are more important than other disciplines?

How can we do it?

There are, of course, several different media that can be and are used in conveying attitudes and knowledge in astronomical subjects: newspapers, TV programs, books, planetariums, interactive exhibits in science centers, lessons in the school. Different media certainly attract different target groups.

For the project to find out is, of course, how planetariums, and possibly adjoining interactive exhibits, can be used. It is not even possible to judge all planetariums the same; there is a great difference between a cozy dome with a live planetarian interacting with the audience and a major planetarium presenting an all-dome show like *Cosmic Collisions* to a few hundred spectators at the time.

As has been shown by several authors, among them Franck Pettersen in a master's thesis (Pettersen, 1995), is that a combination of watching a planetarium show and doing experiments related to the show is very useful. Here are two other voices on interactivity:

Michael Spock, former director of Boston Children's Museum, borrowed the Chinese philosopher Confucius' proverb as a motto for the museum: I hear and I forget, I see and I remember, I do and I understand (cited in Ott 2001).

William Glasser wrote (1990): We learn 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we both see and hear, 70% of what is discussed with others, 80% of what we experience, and 95% of what we teach.

An important component of achieving PUA is likely to be interactivity and hands-on experience, and useful environments for this are science centers and planetariums. Some examples of this are shown in four photos from the Teknoland outdoor science center (2000-2001): yourself a sundial, astronauts' scales, walking on the moon, and Kepler's dance.

A research project proposal

An interdisciplinary and international project on PUA is proposed, with the

hub at Strömstad Academy. It should include both research on the importance of PUA and the impact of methods to achieve PUA. Let me know if you would like to participate! The Strömstad Academy web site and my email address are found at the top of the article.

Several Science Communication master students as well as a number of teacher students at Dalarna University have, during the last decade, written their theses on the impact of planetarium visits and experimenting with astronomy at science centers on school pupils in ages 6 to 18. My own starting point will be to summarize and analyze the conclusions from these studies, which I participated in as their supervisor.

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Top: Yourself a Sundial. Instead of just looking at the shadow of a stick, you have to find the right stone to stand on to make your shadow point towards the white stone. Next: Astronauts' Scales. In the absence of gravity, astronauts determine their weight by swinging, attached to a string. Here the same principle is used by Teknoland visitors who measure the time of 10 full up-and-down swings and then get their weight from a diagram. Next: Walking on the Moon. Hanging in a rope from a 10 m (33 ft) high tower, the resulting force from the pull of the rope and pull of the earth's gravity is approx. 1/6 of the earth's gravity towards the model of the moon. Bottom: Kepler's Dance. Visitors follow the orbits of the Earth, planet Mars and comet Encke in the scale 1:100 billion, and they walk in the pace of a Swedish folk tune. Each step corresponds to two weeks in reality, and the walking speed in orbits are in accordance to Kepler's three laws of planetary motion. All photos by Lars Broman