Although Japan is considered a technologically established state, the Japanese adult's interest in science is very low. Scientific development requires support of the public, and astronomy can be a good entrance to science for the public. In Japan, there are about 350 planetariums and 250 public astronomical observatories. Recently, more Japanese astronomers cooperate with these social educational institutions, science journalism, and school education.

Science plays an important role in technology and economic development. But science also plays intellectual and cultural roles. Science is the same over the world but public culture vary, and public understanding of research (PUR) activities have to reflect these differences. Goals and approaches of education & popularization are somewhat different in various countries. For PUR to succeed, training of science communicator, dialog with citizens, expansion of ‘Outreach’ (For example, information service over the Web, delivery lessons at school), and especially fusion and cooperation of “research community” and “educational community” are needed.

Keywords: Public Understanding of Research (PUR), Dialogue, Interest and Awareness, 4D2U, Astronomy Pub

1. Introduction

Although Japan is considered a technologically established state, the Japanese adult's interest in science is very low. Although Japanese children's academic ability are high according to international tests, interest in science is very low[1]. But, are Japanese children's academic abilities really high? According to the research I conducted in 1994, 40% of the Japanese elementary school students answered that the Sun rotates around the Earth and only 60% of elementary school students know the Earth rotates around the Sun[2].

![Figure 1. Level of Public Understanding of Science (Motomura, 2003[1])]
Table 1 National Difference in Science Level and Interest (Motomura, 2003[1])

<table>
<thead>
<tr>
<th>Nation</th>
<th>World Ranking</th>
<th>Percentage of Liking science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>32nd</td>
<td>96%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>22nd</td>
<td>96%</td>
</tr>
<tr>
<td>Singapore</td>
<td>2nd</td>
<td>86%</td>
</tr>
<tr>
<td>England</td>
<td>9th</td>
<td>83%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>15th</td>
<td>76%</td>
</tr>
<tr>
<td>USA</td>
<td>18th</td>
<td>73%</td>
</tr>
<tr>
<td>Canada</td>
<td>13th</td>
<td>70%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1st</td>
<td>69%</td>
</tr>
<tr>
<td>Japan</td>
<td>4th</td>
<td>55%</td>
</tr>
<tr>
<td>Korea</td>
<td>5th</td>
<td>52%</td>
</tr>
</tbody>
</table>

348 grade school students questioned.

2. Current state of Astronomy Popularity

According to the statistical data of 1997, there are over 2,500 planetariums in the world and 51% of them are in the United States (USA). In Japan, we have about 350 planetariums and 101 of them are over 15m in dome size. This means that Japan is one of the major countries in the world of planetariums. Annual planetarium attendance in the world is estimated at more than 88 million in total. And we estimate around 5 million in Japan.

Japanese planetarians believe planetariums are the most popular and powerful tool for astronomy education.

National Astronomical Observatory of Japan is now producing a new 4D Digital Universe (4D2U) Dome Theater. In the future, I want to change old planetarium system around the world into 4D systems. For further information, see 4D2U web page http://4d2u.nao.ac.jp/ (currently the page is written in Japanese only)[3].

Scientific development requires support of the public, and astronomy can be a good entrance to science for the public. In Japan, we have about 350 planetariums and about 250 public astronomical observatories. Recently, more Japanese astronomers cooperate with these social educational institutions, science journalism, and school education.
Why are astronomical education and popularization important? For example, we should remember the case of "SSC vs HST". SSC was a Large Hadron Collider plan in USA. This big project started in 1991, but was stopped in 1993 by the senate. On the other hand, HST (Hubble Space Telescope) was launched in 1990 and repaired in 1993. This story shows that, scientific development require support of public, and astronomy become the entrance of the science for public.

In Japan, we have about 250 public observatories. Observatories located near cities perform activities similar to science museums. They have exhibitions, planetariums, etc. But their telescopes are used only a couple of times a month. On the other hand, rural observatories have large telescopes and are open every night. Sometime they also do academic research. In the future, Japanese public astronomical observatories need professional personnel, continues evaluation, and international cooperation.

Now, a lot of Japanese astronomers cooperate with science journalism, social education (Public Astronomical Observatory and planetarium), and school education. For example, the following outreach efforts is carried out in the Public Information Office of National Astronomical Observatory.

<table>
<thead>
<tr>
<th>Means of Outreach</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press Releases</td>
<td>around 2 releases/month</td>
</tr>
<tr>
<td>Answering question from the public through telephone, letters &amp; e-mail</td>
<td>around 12,000 correspondences/year</td>
</tr>
<tr>
<td>Star Watching (using 50cm telescope)</td>
<td>around 2/month</td>
</tr>
<tr>
<td>Lecture meeting</td>
<td>around 20times/year</td>
</tr>
<tr>
<td>Information service by Web</td>
<td>around 30,000,000 hits/year</td>
</tr>
<tr>
<td>Information service by a mail magazine</td>
<td>around 100/year</td>
</tr>
<tr>
<td>Institution public presentation</td>
<td>around 20,000 persons/year</td>
</tr>
</tbody>
</table>
3. PUR Culture
Science plays an important role in technology and economic development. But science also plays intellectual and cultural roles. Science is the same over the world but public culture vary, and Public Understanding of Research (PUR) activities have to reflect these differences. Goals and approaches of education & popularization are somewhat different in various countries. Robert Semper (2005) has classified the public understanding of research (PUR) as follows. The PUR Culture in Europe - “Dialogue”, in US - “Understanding”, and in Japan - “Interest and Awareness”. For PUR to succeed, training of science communicators, dialog with citizens, expansion of ‘Outreach’ (For example, information service over the Web, delivery lessons at school), and especially fusion and cooperation of “research community” and “educational community” are needed.

Furthermore, I will introduce (1) 4D Digital Universe project (4D2U) and (2) Astronomy Pub as a new experiment of PUR, and try to evaluate these two NAOJ activities.

4. 4D Digital Universe Project[3]
We have developed the four-dimensional digital universe theater at which we can visualize the observational data and theoretical models of astronomical objects stereoscopically. The astronomical objects cover all scales of the universe from the solar system to the large-scale structure of the universe. We have also produced three-dimensional movies of various astronomical processes based on the results of computer simulations. We plan to distribute all the products of this project through the Internet.

The spatial and time scale of the universe is vastly large. The purpose of the 4-Dimensional Digital Universe (4D2U) project is to scientifically visualize such universe (4D2U also means “4-D to you”). We visualize the universe in 4-dimensions (3-D in space and 1-D in time) by using a stereo-projection system.

We have developed the 4D2U theater system and constructed the 4D2U data. The 4D2U data consists of the observational data, the theoretical models, and the simulation movies. We have established the basic methods for 3-D visualization of these data. We have started the experimental monthly show to the public and met a good public response since 2002. We have also started providing the 4D2U data to museums, planetariums etc. Some of the data are also available on the project web page: http://4d2u.nao.ac.jp/. As the second step, we plan to develop the domescreen 4D2U theater. We challenge to build the world’s first 3-D projection system for a dome-screen. We also plan to develop the portable system, mobile 4D2U theater. It is suitable for the use at classes and the exhibition at museums. We are also preparing to release the 4D2U data through the internet. For the information of the project, please check the above project web page.

Figure 6. Image of 4D2U Dome Theater

5. Astronomy Pub
5.1 Introduction
“Science Café”s, popular in the U.K., are starting to become popular in Japan. Science Cafés are seen as a good way to relax and enjoy scientific discussion. But in Japan, cafés are as not relaxing for the general public as they are in the U.K., and a science café might feel quite similar to a normal science lecture. For a interactive communication in Japan, other methods are needed. So we devised a scientific communication method more adapted to Japanese Culture.

5.2 Characteristics of the Astronomy Pub
The National Observatory of Japan has been performing a “Astronomy Pub” once a month since November 2005 to increase the public’s science literacy and researchers’ social literacy. The main characteristics of the Astronomy pub are:

The 9th International Conference on Public Communication of Science and Technology
1. Limited Participants: Less than 30, so everybody can talk to the researcher and the guest
2. Alcohol: Smoothens lips, makes a easy to participate atmosphere
3. First, a Discussion (Debate) is held on stage:
   This will help the participants’ feel more emotionally involved, or fell attached to one of the speakers.
   This leads to conversations off stage.
4. After 30 minutes of discussion, the speakers will get off of the stage and converse with the participants.
   Rule: Each participant shall not restrain a speaker for more than 5 minutes.
5. Provide witty foods and drinks.
6. An observation can be held after (or during) a Pub. (A mobile telescope set on the terrace)
7. 4D digital universe theater can be played during a Pub.
8. 1 minute walk from a major station (Mitaka). Plenty of places for further drinking, and easy transport to home is available.

Through these kinds of activities we hope that astronomy will stimulate the public’s intellectual curiosity and be have an effect of being an entrance to science. We hope that many institutions, universities, and citizen perform similar activities and contribute to science becoming a culture.

5.3 Results from questionnaires

![Sexes of Astronomy Pub Attendant attendants](image1)

![Sexes of Attendants of Normal Lectures Lecture Series at Mitaka National Univ 2005, 236 attendants](image2)

![Ages of Astronomy Pub Attendants](image3)

![Ages of Attendants of Normal Lectures](image4)

Figure 7. Demographics of Astronomy Pub and Lecture Attendants
6. Conclusion

My conclusion is that Science is the same in the world but public culture is different. Goals and approaches of education & popularization are somewhat different in the different countries. In future, PUR in Japan will need training of science communicator, dialog with citizens, expansion of ‘Outreach’ (For example, information service in Web, delivery lesson at school), and fusion and cooperation of “research community” and “educational community”. Science is Culture. Let's aim at promotion of the science to make people happy. For this purpose, Education and Popularization is very important.

7. References