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INTERNATIONAL WORKSHOP
**EDUCATION
MEETS SCIENCE**
BRINGING POLAR RESEARCH
INTO THE CLASSROOMS

26th to 28th March 2013



ORGANIZATION

ENDORSED



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INTERNATIONAL WORKSHOP

EDUCATION MEETS SCIENCE

Bringing polar research into the classrooms

REPORT

by José Xavier*¹, Inga May*² and Louise Huffman³

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Organizations: IMAR-CMA (University of Coimbra), Alfred Wegener Institute (AWI), British Antarctic Survey, Ciência Viva, Museum of Science of the University of Coimbra

Sponsored by: Scientific Committee for Antarctic Research Capacity Building, Education and Training Committee (SCAR- CBET), Scientific research Programme Antarctic Thresholds – Ecosystem resilience and adaptation (SCAR- AnT-ERA), Museum of Science of the University of Coimbra, IMAR-CMA, Students on Ice and Ciência Viva

Endorsed by: Tinker Foundation, Association of Polar Early Career Scientists (APECS), Scientific Committee for Antarctic Research (SCAR), International Arctic Science Council (IASC), Polar Educators International (PEI), Portuguese Polar Programme (PROPOLAR), International Council for Science (ICSU), European Science Foundation (ESF) and the President of the Republic of Portugal Prof. Aníbal Cavaco Silva

Introduction

The International workshop “EDUCATION MEETS SCIENCE: BRINGING POLAR RESEARCH INTO THE CLASSROOMS”, organized by the Institute of Marine Research of the University of Coimbra (Portugal), the Alfred Wegener Institute (Germany) and the British Antarctic Survey (UK), with the Museum of Science of the University of Coimbra and the national Agency Ciência Viva, was an initiative, following the success of the teachers/educators workshop at the International Polar Year (IPY) 2012 Conference in Montreal and Oslo in 2010.

This was the first workshop that brought polar scientists, teachers and educators together after Montreal. It focused on providing access to tools for teachers and facilitating working together with polar scientists. Also, there is an urgent need for scientists to improve their communication skills, including to school communities, the general public, the media and to policy makers. In addition, by leveraging the diverse international audience and polar education leaders who converged on Coimbra, meeting time was allotted during the workshop agenda for the newly formed Polar Educators International (PEI).

The workshop took place in Coimbra, Portugal, as after the IPY, Portugal continued to be very active in polar science and education, being an ideal sunny country with good developed infrastructures to hold such an event. As an example of a non-polar country, it was crucial that the Portugal polar community, along with the others around the world, kept the established momentum going by continuing to engage teachers/educators, along with their schools, students and the general public, in polar education and in understanding the importance of the Polar regions to our planet.

This eagerly awaited international workshop focused on providing tools for teachers, facilitating working together with polar scientists, and defined a strategy for education and outreach about the polar regions. The main objectives of the workshop were:

- Obtain the basic notions of polar science along with the latest results in the different fields
- Introduce and discuss methods on polar education to bring polar research into classrooms
- Define a strategy for polar educators/teachers for the future (with Polar Educators International (PEI))

We were truly happy to welcome polar scientists, educators and teachers from more than 10 countries from Europe and North America and who made this workshop a real success.

José Xavier and Inga May

Design of the workshop

This international workshop was designed in a way that would maximize the interactions between invited polar educators/teachers and polar scientists. The participants of the workshop were composed of teachers/educators working with students between 4 and 17 years old along with guest polar scientists (including early career scientists). The details of the full program are in Appendix 1.

Prior to the workshop, participants were asked for their input on what they wanted to have discussed during the workshop. A PEI questionnaire was also sent to all participants before the workshop. A blog and facebook page were created (<http://www.facebook.com/groups/445032592244427/>) to keep all participants informed about most recent updates. The planning of the workshop was initiated while still in Montreal in 2012, and skype calls between the members of the coordination committee occurred fairly regularly in the following year.

The morning sessions of the workshop were organized by polar scientists in various fields, whose talks provided the status of their research area while using simple concepts for a wide, non-expert, audience. Particular attention was given to providing general information of the polar regions directed to teachers/educators that were less familiar with them. The science talks were as follows:

- Day one (26th March): Cryosphere and Hydrosphere (given by Inga May and Alexandre Trindade)
- Day two (27th March): Marine Science and Biosphere (José Xavier and Sílvia Lourenço)
- Day three (28th March): Social, Economical and Atmospheric Sciences (David Walton)

In the late mornings and early afternoons, talks by participating teachers/educators showed how they already applied polar issues in their classrooms or how they were linked into national/international programs or organizations (e.g. Among others, Louise Huffman shared the science research and resources created by ANDRILL -- www.andrill.org/education; Antony Jinman's talk focused on his expeditions to the Arctic and on his company ETE-Education Through Expeditions <http://www.antonyjinman.com/education/education-through-expeditions/>; Sandra Vanhove talked about IPF (International Polar Foundation; <http://www.polarfoundation.org/>). The afternoon sessions of the workshop were focused on numerous educational activities, demonstrating phenomena, notions, concepts and basic knowledge about the polar regions that could be applied in classrooms worldwide. The educational sessions were coordinated by Louise Huffman with Patricia Azinhaga, Janet Nadeau, Sandra Vanhove and Wim Van Buggenhout, Matteo Cattadori, Elena Sparrow. Filipa Oliveira (from the Museum of Science) was fundamental in preparing the settings of the demonstrations. Alcides Pereira (Director of Earth Sciences department of the University of Coimbra), along with his members of the department, were crucial in obtaining a demonstrations room. PEI association was introduced to the participants by Sandra Vanhove during lunch time and a discussion on what PEI should do in the future was discussed on the second day in the afternoon.

The late afternoons were composed by discussion panels, whose goals were to brainstorm on assessing gaps of knowledge, identify areas that polar scientists and teachers can work together and how teachers/educators could implement much of this information in their countries and motivate more of their colleagues. The discussion panels were:

- Panel day 1 - How teachers/educators can adapt the information provided here into the classroom?
- Panel day 2 - How to maximize communications between scientists and teachers/educators?
- Panel day 3 - Bringing it all together: What teachers/educators are taking home and what to do in their countries

Each panel session had a rapporteur (Vitor Paiva, José Xavier, Louise Huffman and Sandra Vanhove). The science talks as well as all the materials of the demonstrations (activity sheets) were distributed between the participants and will be also available in the PEI website.

Results and General Discussion

This workshop was a delight to organize! Following Montreal IPY conference, numerous participants already knew each other, whereas the new participants got into the group very quickly. A total of 41 enthusiastic participants from 13 countries participated (Appendix 2), with 17 oral talks (of which 5 were scientific) and demonstrations of 17 activities presented. The oral and demonstrations were very well received. Moreover, the coffee breaks, lunch times and dinner times allowed time for interactions between all, promoting the development of collaborations.

The successful science talks in the morning sessions provided valuable general basic information about the polar regions in the different research areas. The scientists paid attention to using an accessible language, while improving their communication skills, so that all other participants could easily follow. Presentations related to the most recent news and demonstrated how scientists need to connect their findings and provide depth to what their audiences are hearing in the media. After listening to the science talks, the teachers/educators reflected and assessed how they would adapt this information in a way that their students would understand. The powerpoint science talks were gathered and distributed amongst the teachers/educators (to be used in their classrooms) and on the PEI website. In the future, it was obvious that scientists MUST carry out more science communication activities with teachers/educators in educational institutions to ensure their research reaches a wide range of audiences while at the same time these opportunities will help improve the scientist's ability to communicate with a variety of non-technical audiences. Suggestions on how to improve the links between the polar science community and polar teachers/educators are discussed below. Furthermore, it is in the best interest of the Universities to maximize the use of funding for science projects but also for education and outreach (EO) projects. Through excellent EO the pipeline of students is always primed so that colleges are able to attract the best students to their science programs. Much work needs to be done on this front.

The educational activities in the afternoons were typically hands-on. Scientists were generally distributed in different groups, so that they could participate in the activities while providing their opinions. All activities had been field tested successfully by the workshop facilitators in their own countries which was very useful in providing guidance and suggestions for how participants could replicate the activities in their home countries. Numerous teachers/educators mentioned that it would highly beneficial to translate the key activities (e.g. Blubber Gloves, Jenga game, How Does Melting Ice Affect Sea Level? activity, Penguin Family Reunion game, Comparing the Arctic and Antarctic powerpoint game).

Discussion panels

Theme 1: “How can teachers/educators adapt the information gathered during this workshop into their classroom?” With such a question for panel 1, all provided some important views on the difficulties faced by the educational community when trying to relate polar science into the curriculum of each country. Initially it is necessary to get mentors (scientists, experienced educators/teachers) that have already been through this process. Secondly, it is better to do it with colleagues than alone. Therefore, in their home institutions, participants need to get other teachers/educators involved, and the most successful way is by showing their enthusiasm and demonstrating how to apply the activities learned in the workshop in their classrooms. Having a way to motivate peers is important. Thirdly, educators/teachers should manage their time accordingly to their tasks in the school. Countries have different school educational systems and cultures, and therefore have particular constraints that should be put into the equation when assessing how much can be done in an educational year. This is also quite relevant for the scientific community whose time is mostly focused on producing research papers, carrying out fieldwork and collecting data, attending conferences and University teaching. Therefore having POLAR WEEKS twice a year (in March/April and September/October), coordinated by the Association of Polar Early Scientists (APECS) and Polar Educators International (PEI), is quite beneficial to both communities. By focusing their time into these POLAR WEEKS it allows a concentration of energy into producing strong outputs in a short period of time, rather than trying to do everything at all times. Fourthly, having access to materials/resources is essential. Most activities are in the English language, which is still a major challenge for most non-English native educators/teachers and students (according to age groups, access to reliable sources/websites). It has been mentioned that resources of life sciences is more needed than others. Finally, fifthly, it helps if there is a national program that takes educators/teachers to the Arctic or Antarctic to experience the polar regions first-hand while learning how science is conducted and how living and working in such extreme environments is carried out. This is quite relevant because the impact (e.g. skypeing to their school, producing blogs,... using the new technologies) on their students and their peers is considerable, but most importantly, the experience is long term because it continues to affect the teacher’s classrooms for the rest of his/her career as well as surely have a very positive impact in their community.

Theme 2: “How to maximize communications between scientists and teachers/educators?” From a scientist’s perspective, most scientists do not do education and outreach because there are no incentives to do it, and it requires time which is extremely valuable. Furthermore, a considerable number of scientists are uncomfortable when communicating with

audiences who are not their peers and simply are not interested in engaging in science communication with non-technical audiences. With such a busy agenda, where education and outreach activities are not valued in their CV's, most of the education and outreach is carried out by altruistic scientists that really enjoy this part of their job. It has been acknowledged that it is crucial for scientists to know how to communicate their science well to the general public. For their Universities, this is quite beneficial as it will attract more students to these Universities. Some scientists do put a considerable effort in going to schools and obtaining funding to do education and outreach activities. The future will be focused on scientists that do excellent science but who also have excellent communication skills and are able to explain their findings in simple terms to a wide range of people, including their peers, the general public, the media and to policy makers.

Theme 3: "After such a workshop, what must educators/teachers take home?" At this panel discussion, educators/teachers/scientists were put into groups to come up with 3 main products/ future steps. The workshop worked nicely with this format (i.e. 1-2 teachers/educators from countries that are engaged in polar science (e.g. we need to engage teachers/educators from Argentina, Australia, Austria, Belarus, Brazil, Chile, China, Colombia, Cuba, Czech republic, Denmark, Ecuador, Estonia, Greece, Guatemala, Finland, Hungary, India, Japan, Korea, Malaysia, Monaco, New Zealand, Norway, Pakistan, Papua New Guinea, Peru, Poland, Romania, Russian federation, Slovak republic, South Africa, Sweden, Turkey, Ukraine, Uruguay, Venezuela) plus polar scientist experts in their fields). It was proposed to have another workshop in Germany in 2015, inviting the same participants, but also inviting more classroom teachers/educators of the countries that were not represented. A mini-workshop, organized in their own countries (at a national/regional/local/school level) should be organized already in 2014, possibly within a POLAR WEEK, and results sent to PEI. Finding options for funding these activities is one of the challenges that participants will face. It was crucial to keep the enthusiasm and interest within a productive group like this. Knowing that there are a number of international colleagues that have been highly active, was essential in letting participants know they are not alone. If help is needed, the distance is just of an email. Secondly, getting familiar with the most successful activities is important, and applying them in the classroom. Asking for the help of a colleague and of a scientist should be common. Thirdly, an evaluation of the main resources should be made for translation. Fourthly, use web 2.0 to communicate between peers (e.g. using facebook) to share success and failure stories as well as new activities that can be implemented in classrooms and to seek support. Fifthly, write a small article to their school journal. Sixthly, participate in national polar programs when possible and participate in SCAR, IASC, APECS, PEI initiatives in international and national conferences. At a national level, some educators will do national/regional workshops for educators/teachers, produce a newsletter article, incorporate this information into broader projects on education (e.g. GLOBE), be engaged with the national polar organizations, make access of these educational materials to a broader group of communities and be participating in conferences. Others will focus more at a local scale, trying to engage colleagues, organize mini-meetings to share activities, give important talks in schools, translate the activity sheets into their native languages and try to engage the media.

Polar Educators International (PEI) section

The Polar Educators International (PEI) is a global professional network for those who educate in, for, and about the Polar Regions (includes enthusiastic and passionate teachers, educators, scientists, community members). Although formally started in the last IPY conference in Montreal 2012, their roots started in 2005-2006 with the IPY and IPY International Polar Office planning meetings and carried out through the IPY, by the sub-committee for Education and Outreach of the IPY and APECS. In 2013, it had more than 200 members from 24 countries worldwide and growing. At our workshop in Coimbra, we had numerous members of the PEI, including from the steering committee and council members, such as Louise Huffman, Sandra Vanhove, Antony Jinman, Patricia Azinhaga, Matteo Cattadori and Inga May. We kept a close contact with other members such as Dave Carlson, Heidi Roop, Sarah Crowley and Sophie Weeks. On the first lunch break, PEI was briefly introduced to all participants by Sandra Vanhove and a brainstorming session was carried out on the second day on “next steps for PEI”. The most relevant were:

- PEI must get mentors onboard, to provide strong guidance and build bridges between organizations at the highest level
- PEI must assess what already has been done during and after the IPY, and in APECS/SCAR/IASC today, to avoid replication of activities
- PEI must have a strategic view of links with other organization. Memorandum´s of Understanding with other related organizations will be of high value, at a polar level (e.g. APECS, IASC, SCAR, CliC, COMNAP, at ATCM meetings) and at an international level beyond polar to strengthen the position of PEI and stimulate collaborations
- PEI must establish simple, and achievable goals, in the short-term with a long-term vision plan (at an international, national and local (i.e. schools level). These include the establishment of national committees (and national programs), promote networking, assess the quality of educational resources already available (selecting the one´s that should be endorsed by PEI), identify gaps of knowledge and areas the PEI should be focused on (e.g. integrate scientists into education and outreach) and a PEI newsletter (e.g. on news, recent activities and opportunities for workshops, conferences, participation of polar expeditions).
- PEI must assess how to attract more polar scientists into education and outreach, by helping scientists in establishing new research projects with a strong educational component (including having an educator, or a group of teachers, within the project), help polar scientists to coordinate and publish educational material in international educational journals (that will aid scientists/educators publication record), and facilitate access of materials that scientists could use when coming to schools (e.g. provide simple protocols on what an inexperienced polar scientist should do, e.g. “what I should do if I contacted by a school”, “tips to how to give a talk in a school?”, “Is it different speaking to a 3 year old in relation to a 16 year old?”; see IPY resource book, Kaiser et al. 2010) and obtain funding to take scientists to the schools. A protocol on polar scientists that already go to schools, should be asked to provide their presentations to be widely available at the PEI website.
- Search for funds for a secretariat to coordinate PEI at an international level and activities merging PEI members and polar scientists

Final remarks

Thank you for making our workshop such a huge success. We managed to bring polar scientists and teachers/educators together (with scientists providing lectures and materials to be given to the teachers/educators), and were able to have some of the most experienced polar teachers/educators giving demonstrations of activities that can be implemented in classrooms and defined a group of suggestions for the implementation of a strategy of PEI. We are looking forward to carrying on addressing these major challenges in the future with you. Our immediate tasks are the following:

- Produce an editorial for the journal *Antarctic Science*
- Produce an article to an educational journal (and to be replicated amongst the participants organizations and countries)
- Evaluate the production of an information paper to the 2014 ATCM in Brazil.
- Help the new PEI executive committee to implement the PEI strategy.

An evaluation form will be distributed amongst participants to assess the MUST DO in the next international workshop, which is planned to be in Germany in 2015!!!

Acknowledgements

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Appendix 1. Detailed Programme

Day 1 - Cryosphere & Hydrophere

8.30-9.00	Registration
9-9.30	Opening ceremony with João Carlos Marques (Director of IMAR – CMA), Paulo Gama Mota (Museum of Science) and Margarida Suarez (Ciência Viva)*
9.30-10.30	Introduction to workshop (José Xavier, Inga May and Louise Huffman) - participants & facilitators introduce themselves

- 10.30-11.00 Break
- 11.00-12.30 (Inga May and Alexandre Trindade) Lecture
- 12:30-12:40 (Sandra) Introduction of PEI and invitation to take part in discussions during lunch each day
- 12:40-2:00 Lunch break and PEI meeting
- 2:00-3:15 (Louise) Earth systems approach to climate change—Biosphere, Atmosphere, Geosphere, Hydro/Cryosphere & Energy— ELF & CLEAN collections of resources
 --Set-up “How Does Melting Ice Affect Sea Level?”—activity
 --Great Ocean Conveyor Belt—activity
 (Louise) Carbon Journey--activity
 (Wim) Carbon Eaters-demo
 (Louise) Revisit Melting Ice
- 3:15-3:30 Break
- 3:30-4:00 (Janet) Methane Hydrate Molecules--activity
- 4:00-4:30 (Matteo & Wim) Historical Exploration--activity
- 4:30-4:50 (Louise) Summarizer: Polar Science Acronym
- 4:50-5:00 Break
- 5.00-5.30 (Jose, Inga, Janet, Louise, Sandra and David) Panel discussion on teacher issues including how to incorporate polar science into classrooms and curriculum
- *Ana Quartin and Sónia Silva sent a message in name of the Foundation of Science and Technology of their support of the workshop

Day 2 - Marine Science and Biosphere

- 9-10.30 (José Xavier and Sílvia Lourenço) Lecture
- 10.30-11.00 Break
- 11.00-12.00 (Antony*, Louise, Sandra, Matteo, Elena) Presentations from educational projects
- 12.00-12.30 (Elena) Why Do We Have Protocols?—activity
- 12:30-2:00 Lunch break and PEI meeting

- 2:00-2:45 (Patricia) Weddell Breath Holding—activity
--Get Ice Cream—activity
- 2:45-3:30 (Louise) Blubber Gloves—activity
--Plates and Gates—demo—related to Weddell Seals Adaptations activity
- 3:30-3:45 Break
- 3:45-4:00 (Jose) Jenga Food Web—activity
- 4:00-4:20 (Louise) Summarizer: Great Thoughts
- 4.20- 4:30 Break
- 4.30-5.00 (Jose, Inga, Janet, Louise, Sandra and David) Panel discussion on teachers' issues
(interacting with scientists)

*talk of Antony was given before José's talk

Day 3 - Social/Economic/Atmosphere

- 9-10.30 (David Walton) Lecture
- 10.30-11.00 Break
- 11.00-12.30 (Wim, Rainer, Patrícia, Janet, Iglia, Javier and Markus) Presentations from
international/national educational projects
- 12:30-2:00 Lunch break and PEI meeting
- 2:00-2:50 (Sandra & Matteo) Albedo—activity
- 2:50-3:10 (Louise) Earth's Albedo—activity
- 3:10-4:00 (Sandra & Matteo) Sun Shadows—demo
- 4:00-4:15 Break
- 4:15-5:00 (Participants) Planning and preparing a presentation for colleagues and students
- 5:00-5:30 (Jose, Inga, Janet, Louise, Sandra and David) Panel discussion on what teachers are
taking home
- 5:30 – 6:00 Closing ceremony

Appendix 2. Participants

1. José Xavier <jccx@cantab.net> (PT and UK)
2. Inga May <inga.may@awi.de> (GER)
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*Apologized for not being present but will be informed about the results

Appendix 3. Group photo International workshop 2013.

