Project title: **Cultures of Mathematical Research Training**
Requested amount (€): 29,800

Applicants
Lead Applicant (Organization): International Union for the History and Philosophy of Science

The IUHPS has agreed to allow this project proposal to go forward in its name.

Supporting Applicant(s) (Organization(s):

The proposal is that the International Mathematics Union and the International Commission on Mathematical Instruction should participate in the project as supporting applicants.

How will this proposal address ICSU's strategic priorities as defined for the grants programme?

This project is directed at Capacity Building and Science Education, especially in developing countries. Its focus is on the training of new researchers, that is, in doctoral and post-doctoral programmes. It may also consider recent developments in information technologies, insofar as these have a bearing on research training.

This project will create a forum for dialogue between science and policy communities, and will contribute to the knowledge-base relevant to policy formation in the area of the training of mathematical researchers.

Objectives

This project aims to mobilise the energies of a currently very active research area (the study of mathematical practice) to provide the theoretical and empirical resources for designing improvements to the training of the next generations of mathematical researchers and the improvement of research education in developing countries.

Researchers on mathematical research cultures will focus on the perspectives of new entrants to mathematical research and develop a theoretical framework for further discussions on various levels, including the policy level. We anticipate that analytical tools developed in cultural studies and cultural anthropology (such as power-distance, or grid-group analysis) will help the identification of research cultures and their associated obstacles and opportunities.

During the course of the project, we will develop a concrete plan for a survey project of various mathematical research-cultures that is of common interest to both academic researchers in mathematical practice and the societal stakeholders (e.g., funding agencies, universities, research policy officials and international bodies such as the IUHPS and the IMU.).

Project description

A mathematics research student must become a mathematician in the fullest sense, including assimilation of one or more mathematical research cultures. In this sense, enculturation into a mathematical research culture is an aim of researcher education. At the same time, with no suggestion of malice or prejudice on the part of established mathematicians, mathematical research

cultures may be more welcoming to some students than to others. In this sense, mathematical research cultures can present obstacles to the internationalisation of research training, obstacles to talented junior researchers from certain cultural backgrounds thriving in research contexts, and obstacles to developing countries realising their potential.

In recent years, a community called 'Philosophy of Mathematical Practice' (PMP) has become very active, as witnessed by the formation of a learned society (Association for the Philosophy of Mathematical Practice: founded in 2009, inaugural conference in Brussels 2010) and numerous research projects and conferences. The PMP community seeks a rich and detailed appreciation of actual mathematical practice. This requires close cooperation between philosophers, sociologists, researchers in mathematics education, historians, cognitive scientists, psychologists and anthropologists.

In the last two years, the research of the PMP community moved towards understanding the role of culture and cultural embedding of mathematical practice. For instance, this was the topic of two meetings entitled "Mathematics as Culture and Practice" at the ZIF in Bielefeld (May 2010) and the Alfried-Krupp-Wissenschaftskolleg in Greifswald (December 2011), a special invited symposium entitled "Mathematics and the new technologies" at the 2011 congress of the IUHPS-division for logic, methodology and philosophy of science, the AHRC project "Mathematical Cultures" with three workshops in London (2012-2014), and, recently, an international conference "Cultures of Mathematics and Logic" in Guangzhou, China (November 2012).

This 'cultural turn' of the PMP community opens the possibility of linking the academic interest in understanding the structure of research culture to the practicalities of the enculturation of new researchers into mathematical research cultures.

So far, there have been few links between the community of researchers studying mathematical research cultures and the societal stakeholders, so the first task for this project is to create the necessary contacts. This take place in two stages:

Stage 1. A small group of researchers from the PMP community will meet with science policy makers and officers of international societies that have been involved in similar enterprises at slightly different levels. The main goal for this meeting is to agree on a list of participants and a precise agenda for the second meeting. The meeting take place in a country that will minimize travel expenses. We expect three to four representatives of the PMP community, a representative of the IMU, a representative of the Pipeline project (run by the IMU), one or two representatives of national or international research funding agencies, a representative of an international research policy agency.

One of the participants will host this meeting at their institution.

The outcomes of stage 1 are a list of participants and an agenda for the second meeting.

Between stage 1 and 2. We expect that up to two preparatory meetings will be necessary with a representative of IUHPS travelling to the institution of one of the invited participants of the second meeting.

Stage 2. The main meeting of the project will take place at Corpus Christi College, Cambridge (UK) where we have the support of the Master and Fellows of the College. The purpose of this meeting is to develop a plan for a large-scale project of studying and surveying mathematical research cultures and their differences. The main outcome of the project will be:

(i) a project plan (probably for three to five years) that describes which research cultures should be studied, with which analytical tools and how to collect the appropriate data (e.g. the plan might recommend some combination of surveys, interviews, focus groups, field anthropology, corpus analysis, historical scholarship and philosophical reflection).
(ii) a plan for funding the project plan listed in (i).

The project is timely. As the PMP community has increased its capacity for the empirical investigation of mathematical cultures, it is now possible to give this research a direction that can have application at the level of policy and society.

Relevance to review criteria

Scientific merit: this project draws on the expertise of an established scholarly community that has already developed rigorous methods for the investigation of research cultures.

Relevance to the ICSU Strategic Plan and the priorities of the ICSU Regional Offices: this project will support a central element of the ICSU strategy, namely, capacity building, especially in developing countries.

Innovative nature: the study of mathematical culture has not been directed to this practical end previously.

Interdisciplinary and international focus: the study of mathematical cultures is inherently interdisciplinary. The project will explore mathematical research cultures in a range of national contexts.

Broad participation: this project will involve scientists, scholars and policy experts.

Visible and measurable outputs: the outputs will be a plan for a larger project and a proposal for funding it. These will be assessable as practical proposals in the usual way for scientific projects.

Potential for developing follow-on activities: the outputs are designed precisely to facilitate follow-on activities.

Targeting of priority groups

It is crucial for this project that the project plan in (i) is informed by the societal stakeholders who will guide the PMP community in their decisions in order to make societal and policy applications more likely.

Therefore, the success of this meeting depends crucially on the selection of stakeholders. We expect that the people present at the spring meeting will be present at the fall meeting as well. In addition, we will invite representatives of national and regional ministries of research and education,

representatives of regional learned societies of developing countries, representatives of national and regional funding agencies, representatives of international research institutions or research dissemination institutions (such as journals).

Work plan

The project has two principal stages:

Stage 1. Meeting in Spring 2014.

In Spring 2014, a small group of researchers from the PMP community will meet with science policy makers and officers of international societies that have been involved in similar enterprises at slightly different levels. The main goal for this meeting is to agree on a list of participants and a precise agenda for the second meeting.

The outcomes of stage 1 are a list of participants and an agenda for the second meeting.

Between stage 1 and 2. We expect that up to two preparatory meetings will be necessary with a representative of IUHPS travelling to the institution of one of the invited participants of the second meeting.

Stage 2. The main meeting of the project take place in the late fall of 2014 at Corpus Christi College, Cambridge (UK). The purpose of this meeting is to develop a plan for a large-scale project of studying and surveying mathematical research cultures and their differences.

Methodology: at stage two, participants will map established techniques in the study of mathematical practice onto priority policy areas recommended by international, national and local research officials.

Leadership and management: responsibility for leadership and management will lie with Prof. Dr. Benedikt Loewe and Dr. Brendan Larvor, both of whom have extensive experience in academic administration, including the management of international research projects. In order to keep the group manageable and have meaningful discussions and debate, there will be no more than 20 participants. This obviates the need for a more elaborate leadership structure.

Expected results (max 1/2 page)
Outcomes: the principal outcome will be a plan for a large-scale project of studying and surveying mathematical research cultures and their differences, together with a proposal for funding it.

Dissemination will take the form of developing the institutional relationships necessary to carry this plan out. The project will have a web presence and the participants from the PMP community will report on it at usual PMP conferences and other events (this application does not include funding for attendance at these).

An ICSU grant will make it much easier to seek funds for the study of mathematical practice from such bodies as the UK Research Councils or the German Research Board. The plan developed at the second meeting will easily translate into funding proposals to national research bodies. Since these

bodies increasingly require research proposals to offer some societal good beyond the immediate research community, we anticipate that proposals arising from this project will be attractive to national research funders.