

EDITORIAL

Threshold concepts and troublesome knowledge

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This special edition of *Planet* arises from the GEES Subject Centre's residential conference, entitled *What on Earth ...? Student Learning in Geography, Earth and Environmental Sciences*, held at the Quality Inn, Plymouth at the end of June 2006. The issue, divided into three sections, contains articles from the keynote speakers, discussions and swap shop presentations at this event, as well as articles submitted in response to a call for papers on the topic of threshold concepts and troublesome knowledge. Some of the papers explore the topics directly, whilst others describe practices that have been found to enable student learning in difficult areas.

The purpose of the summer conference was to consider key concepts, student misconceptions, and bottlenecks in learning in higher education. The event was centred around participant-led, structured discussion, and opportunities were provided for GEES learning and teaching practitioners to explore how to:

- Trigger those 'aha' moments
- Enable understanding of complex and key concepts
- Overcome common misconceptions and bottlenecks
- Enable literacy and numeracy in GEES
- Design effective learning opportunities.

The participants individually listed the threshold concepts in their subject area, then in groups of four prioritised these. The themes for discussion were then collated from the priority list by the three keynote speakers (Julie Libarkin, Patrick James and Glynis Cousin). These facilitated 'learning groups' then worked together for the whole of the second day to discuss the six key issues selected, to share experiences and develop possible solutions. Interspersed with the group discussions were keynote presentations and opportunities for participants to present examples of their own practice in a 'swap shop' style. The full list of concepts identified by the participants is provided at the end of this volume. The key concepts prioritised for discussion were:

- Quantification
- Time
- Knowledge, evidence, complexity and uncertainty
- Spatial literacy
- Interdisciplinarity
- Sustainability and globalisation

Section 1: Introduction to threshold concepts

So what exactly are threshold concepts? In the first section of this publication the three keynote speakers from the conference provide their thoughts and some examples of how to help GEES students to master such concepts. Glynis Cousin's paper provides a theoretical but accessible background to the notion of threshold concepts; the following key ideas are presented and these also arise repeatedly in the discipline-based discussions and examples of practice that follow in Sections 2 and 3:

- Overcoming the 'stuffed' curriculum;
- Difficulties for teachers trying to retrace their learning journey (remembering what it's like to be a novice learner);
- The importance of listening to students and not making assumptions about their prior learning or needs;
- The need for curriculum design that allows students to explore and question the concepts for themselves;
- The recognition that some scientific phenomena are so different from everyday life that students may find learning about them problematic;
- Learning is an emotional as well as a cognitive experience and mastering threshold concepts may be a messy/iterative process: students need to be reassured that they are not the only ones having difficulties and that their peers may also be struggling.

Julie Libarkin then takes up the story of threshold concepts and applies it to learning in the geosciences and Pat James follows with some highly active learning exercises to help students overcome some geological misconceptions. Although these examples are from a particular, geological, perspective readers are encouraged to consider how the general ideas behind the approaches might be adapted for their own elements of GEES.

The final two papers in this section build on the ideas that have gone before and provide outlines of the proceedings of a multi-disciplinary conference on threshold conference held in Glasgow a couple of months after the GEES conference.

Section 2: Discussion groups

As described above, the GEES conference enabled the participants to discuss their own choice of threshold concepts in the disciplines. The groups met three times: (1) to discuss the key issues relating to their concept; (2) to discuss examples of practice; and (3) to put together conclusions and recommendations arising from their discussions. The summaries of these discussions are provided in Section 2 together with additional information and resources on the themes from the relevant literature.





These 'field trips,' coupled with a workshop-style conference and the stunning backdrop of the National Marine Aquarium for the conference dinner, provided an environment conducive to lively discussion, innovative ideas and, ultimately, a highly successful and enjoyable event. However, the success of any event is down to the hard work and engagement of the participants and I'd like to thank all those who came along and shared their ideas and experiences.

So, from our experience of running the conference and from ideas and comments arising from the participants, I would suggest that perhaps the key element to arise was the reinforcement of the notion that active learning might be the best approach to support the understanding of difficult concepts. As Pat James notes:

"Engagement promotes interest and motivation. Its purpose is to capture students' imagination and motivate them to want to find out more, to both inquire and to learn."

Section 3: Examples of practice and pedagogic research

In between the discussions, three parallel 'swap-shop' sessions were run to allow colleagues a chance to more formally present their examples of practice. Some of these examples are provided in Section 3, along with other submitted papers.

In addition to the main event, a pre-conference workshop was held to facilitate networking for colleagues undertaking or interested in pedagogic research. Around 30 colleagues got together to share ideas, find out each others' areas of interest and generally get to know one another. An annotated list of the network participants can be found on the GEES wiki at <http://gees.pbwiki.com/> (click on 'pedagogic research').

A small number of examples of current research interest is also provided in this section. As well as sharing their individual experiences and approaches to pedagogic research, the participants also had an opportunity to hear about activities going on elsewhere in the world, and Julie Libarkin's article describes the environment for such research in the US.

Overall summary

The GEES conference in the summer of 2006 provided an excellent opportunity for colleagues to get together and discuss discipline-specific issues in learning and teaching. Active learning was very much the basis of the structure of the conference and participants were involved, even before the event, through organised visits to the Eden Project in Cornwall (<http://www.edenproject.com/>) and an evening river cruise up the Tamar Valley that provides the boundary between Devon and Cornwall.

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