

{Previous article was here - see below for next article}

Mathematicians as educational co-researchers

Interim Project Report June 2003 - Written by: Elena Nardi, UEA

The LTSN-funded project *Mathematicians as educational co-researchers* seeks to engage practicing mathematicians as educational co-researchers in developing educational theory and teaching practice alongside experienced colleagues from mathematics education. In the early weeks of October 2002 the project commenced by developing six 'data sets' on the following themes:

- Theme 1 - Formal Mathematical Reasoning I: Students' Perceptions of Proof and Its Necessity
- Theme 2 - Mathematical Objects I: the Concept of Limit Across Mathematical Contexts
- Theme 3 - Mediating Mathematical Meaning: Symbols and Graphs
- Theme 4 - Mathematical Objects II: the Concept of Function Across Mathematical Topics
- Theme 5 - Formal Mathematical Reasoning II: Students' Enactment of Proving Techniques and Construction of Mathematical Arguments
- Theme 6 - Collaborative Generation of Research Findings in Mathematics Education

A data set consists of:

- A short literature review on the theme supplemented by a bibliography of educational research.
- Samples of data on the theme including students' written work and excerpts from interview transcripts collected in the course of the authors' previous projects and doctoral work.

There are usually five sets of examples in each data set, each on one mathematical question. The group of mathematicians participating in each data collection cycle was asked to study the data set prior to a half-day

meeting and be prepared to discuss their responses to the literature and the data sample during a focus group. They were also encouraged to support these views with brief samples of data that they have collected themselves.

The data collection phase of the project has now been successfully completed using these data sets. Six cycles of data collection took place at the School of Mathematics, University of East Anglia. Five of these cycles have been replicated elsewhere (cycles 1X – 5X), at The University of Birmingham, The Open University, The University of Swansea and Heriot Watt University, Edinburgh. Finally, a working session took place at the Mathematical Association Conference, during May 2003. The focus group discussion at all meetings, except cycle 4X at the conference of the Mathematical Association, was audio-recorded on a digital sound recorder. The two researchers also brought along further examples to supplement and elaborate the issues raised in the data set.

Data analysis is now in progress. Once a recording was complete, a full transcript was produced. Each recording, approximately 200 minutes long, gives a verbatim transcript of about 30,000 words. This text is roughly structured in parts according to the structure of the data set. Within each part, the structure of the discussion may vary. Sometimes the group starts from a theoretical

analysis of the knowledge needed to attempt the mathematical problem in the question. This includes their own ways of responding to it, the question-setter's intentions, the prerequisite knowledge etc. Discussion then proceeds to an examination of the students' examples and to address the general cognitive and pedagogical issues. Of course, the conversation shifts backwards and forward from all of the above. As intended by the focus group methodology, the intervention by the two researchers is minimal and mostly of a coordinating and sometimes consolidating nature.

The above structure, determined to a large extent by the participants but implicitly also dictated by the structure of the data set, has led to an almost natural emergence of 'episodes' from the text. These are self-contained pieces of conversation with a particular focus. It is intended that these episodes will become the analytical units and it is envisaged that from the cycles of data collection 1-6 (plus the supportive data from cycles 1X-5X) approximately 150 such episodes will emerge. Such an analysis is very much in the spirit of the methodology of data-grounded theory. This methodology has been successfully applied to the data from cycle 1, to produce the conference paper detailed below.

Two researchers are currently engaged with a first-level analysis, attempting to reach consensus on their definition of the episodes. Each working independently on a part of the transcript, they aim at achieving an agreement on a breakdown of each part in episodes. A story is then written up for each Episode, approximately 500 words long, namely a text which summarises the content as well as highlights the conceptual significance of the episode for subsequent stages of analysis. A second-level analysis, currently also in progress, focuses on the content of these stories.

Ultimately the analysis of each episode will help to

identify cross-episode patterns in attitudes, beliefs and practices. As a preliminary evaluation of the methodology used in the study, we wish to suggest that the collected data are extremely rich. As a result of the analysis now in progress, we anticipate that the aims of the study will be fully achieved. In particular, the aim relating to the collaborative nature of the research: the vibrancy of the group's views and the enthusiasm with which the members of the group engage in the conversation is helping the content of the conversations escalate beyond the remit of the pre-determined themes. In this sense the data set, while offering a concrete, solid basis for discussion, does not appear to be a straightjacket imposed by the researchers on the participants. Indeed the participants, by constantly re-shaping the focus of the discussion, are determining the actual content of the data and eventual focus of the research. They are thus becoming co-researchers – which is at the heart of what we believe to be the main aim of our study.

The findings will be presented in brief

- in the following conferences:
PME27 <http://www.hawaii.edu/pme27>
UMTC <http://www.umtc.ac.uk/umtc2003/index.htm>
BSRLM <http://www.bsrlm.org.uk/> conferences
- in the Mathematics Education Summer School in Greece, 21-27 August 2003
- in a more substantial journal article to be submitted by Christmas 2003

Reference

Nardi, E & Iannone, P (2003) Mathematicians On Concept Image Construction: Single 'Landscape' Vs 'Your Own Tailor-Made Brain Version', *Proceedings of the 27th Annual Conference of the International Group for Psychology in Mathematics Education*, 13-18 July 2003, Honolulu, USA