WS5 SYMBOLIC COGNITION IN ADVANCED MATHEMATICS

Stephen J. Hegedus
University of Massachusetts Dartmouth
Ted Eisenberg
Ben-Gurion University, Israel

David O. Tall
University of Warwick, UK
Gary Davis
Washington State University

Symbolic Cognition is the study of the construction of mathematical signs and symbols and the processes involved in manipulating such objects into meaningful concepts, procedures and representations. More practically it aims to understand the ways in which symbols help us to do mathematics, through consideration of the evolution of symbols and their role in the intellectual development of the learner from early beginnings through to maturity. Over the past two years, more than 100 researchers from around the world have met at the International PME meetings to discuss this new line of inquiry which culminated in an email discussion group and a constructive body of work (see www.symcog.org for details of work to date). Recent work at PME meetings has developed a three-fold mode of inquiry with associated research questions:

1. The use of symbols in human activity and theories of their use, e.g. theories of symbol-systems, semiotics, etc, how they interrelate and their roles,
    What do we refer to when we say symbol?
    What make pictures symbolic?
    What is a symbol system?
2. The specific use of symbols in mathematics,
    How do you learn or not learn symbols in advanced mathematics?
    What are symbols good or bad for with reference to the work of mathematicians?
3. The role of symbol-use with new technologies
    What is the unique contribution of the representational system in both old and new technologies?

Within the environment of mathematical thinking our discussion has moved from understanding how symbols are tools with which to mediate communication to observing how symbols are part of larger systems which might co-evolve with human cognition or are artifacts of a culture to support mathematical ideas. Following this preliminary work, we wish to examine associated datasets relating to such study of symbolic cognition. These include student work, classroom observational data, data relating to pre and in-service teacher development, and more generic open-ended data given the opportunistic and evolving nature of this inquiry. Specifically these might include mathematical work in various forms including paper, electronic work files (e.g. Word processing, Computational mathematics, Simulatory environments, Dynamic Geometry Environments, Statistics etc.), pre-post tests, affect questionnaires, video/audio files, databases, historical artifacts, paintings, and many more.

Datasets for initial inquiry will come from our preliminary work and established community but we aim to promote members of the group to contribute to the session in mutually supportive ways.