CURRENT REPORT

CERME7 Working Group 16: Different theoretical perspectives and approaches in research in mathematics education

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CERME7 WG16 papers provide evidence of progress made since the central term of *networking* emerged at CERME4. WG16 aims to understand how theories can be connected successfully while respecting their underlying conceptual and methodological assumptions, a process we call 'networking theories'. At CERME7 the manner in which a theory conceptualises, and accounts for, *the emergence and nature of mathematical objects* was often related to the question of the theory's underlying conceptual assumptions.

Font et al. explore this question by synthesising the onto-semiotic approach (OSA), APOS theory and the cognitive science of mathematics, as regards their use of the concept 'mathematical object'. OSA extends the other theories by addressing the role of semiotic representations. *Sollervall* uses Peirce's semiotic triangle and Duval's theory of registers to negotiate disciplinary and individual perspectives on the notion of meaning in mathematics. In *Santi*'s paper, two semiotic approaches are coordinated, providing complementary views of Duval's and Radford's theories which can only be linked in a diachronic way due to strong differences in theoretical principles. *LaCroix* compares Cultural Historical Activity Theory, Engeström's interpretation and Radford's theory of knowledge objectification.

Some papers explore cognitive and social dimensions. *Jay* offers a reconciliation of perspectives with a semiotic approach which appears to propose a neutral arena for negotiation of definitions of crucial terms like concept, understanding and learning. In *Kidron, Bikner-Ahsbahs and Dreyfus,* 'networking theories' focus on two theoretical concepts: the need for a new construct, and interest. A new phenomenon emerges that enriches both views: General Epistemic Need, which appears as the driving force that makes students progress in their learning processes. *Craig* deals with the social context of research, and offers a way of exploring patterns of research collaboration within mathematics education research.

Networking theories were also used to analyse mathematical classroom discourses. *Ligozat, Wickman and Hamza* look at classroom activities from institutional and participant perspectives, and combine two theories which focus on social

aspects. *Tabach and Nachlieli* offer an example of networking two theories which focus on socio-cultural and linguistic approaches. Some papers deal with networking theories where there is a strong family resemblance. *Douek* coordinates socio-cultural theories to answer the question of how to deal with the learning difficulties of poor learners. *Goodchild* considers the Communities of Practice approach and Activity Theory. The theories have incompatible elements, but there is value in using both perspectives in teacher development research. Considerations of 'inquiry' lead to viewing communities of inquiry as a critical extension of CoP. *Kaenders, Kvasz and Weiss-Pidstrygach* present categories of mathematical awareness connected to activity theory.

A central term to emerge from the working group's discussions was *transformation*: after networking theories, researchers are often transformed and are able to see things which they could not see before. Negotiating meanings as a sub-issue here concerns the conditions which permit fruitful dialogue. Radford's (2008) *semiosphere*, where a theory is considered as a dynamic interrelated triplet (P, M, Q) formed of theoretical principles (P), methodologies (M), and research questions (Q), was repeatedly raised. The paper by *Mason* offers a reflection on the nature of theories in mathematics education. Following the discourse of the structure of attention, theories foreground some aspects and so necessarily background others. *Monaghan*, in analogy with 'instrumental genesis', introduces the notion of 'theoretical genesis'. Factors involved in theoretical genesis include writing, learning, engagement with research and other voices. For Monaghan, theories cannot be separated from the people theorising. *Artigue, Bosch and Gascón* consider the potential offered by the Anthropological Theory of Didactics (ATD) for addressing issues of networking theories, which they term 'research praxeologies'. ATD, with its central notion of praxeology, is offered as a methodology for 'networking theories', to help address the essential issue of the functionality of theoretical frameworks. Some efforts were made in the working group to find links between the approaches by Radford, Mason, Monaghan and Artigue et al., in order to better understand the challenges surrounding the problem of networking theories in mathematics education. Initial considerations focused on the possible use of these approaches in the concrete examples of networking to be found in the papers in the working group. These considerations directed participants to the challenging task of networking 'approaches for networking theories'.

Note

The research papers and poster submissions published in the CERME7 proceedings related to this topic can be accessed from the hyperlink at http://www.erme.unito.it

Reference

Radford, L. 2008. Connecting theories in mathematics education: Challenges and possibilities. *ZDM – The International Journal on Mathematics Education* 40, no. 2: 317–27.