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## **An introduction to TWG20: Knowledge, beliefs and identity**

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### **An overview of TWG20 at CERME13**

At CERME13, TWG20 had 28 papers and 6 posters presentations. TWG20 participants came from 16 different countries around the world, not only from Europe. During the conference, in TWG20 first session, after a short introduction, the group was involved in the presentation of all the posters. This gave many young researchers the opportunity to discuss their work with the whole TWG20 and it was much appreciated in view of the general poster session. Due to the large number of participants, in some sessions we had to split the group into Group A and Group B. The division into these two sub-groups was intended to balance different topics and contexts. In previous CERMEs, the TWG20 opted for a division based on the three main themes of the name of the group, having knowledge in one group as main topic, and beliefs and identities as the second group focus. For CERME13, we decided to take a more integrated approach by creating two heterogeneous groups to foster discussions that linked the three main topics. Four parallel paper sessions for each sub-group (groups A and B) were carried out, and then we ended up with two final all-group sessions about reflections on the main issues emerged and on the future perspectives.

In CERME13 TWG20, the majority of participants were not only new to the group, but also newcomers to ERME conferences. Many of them asked for some information about the historical background of the group. Therefore, in this introduction we will assume a temporal look to our group, giving a brief overview of the last ten years of work, from the CERME8 to CERME12. We will then share some issues that emerged during TWG20 discussions and some reflections, looking to the future and hoping that they can be addressed at the next CERME.

### **A look back over ten years: From CERME8 to CERME12**

Ten years ago, at CERME8, the only TWG dedicated to teacher-related research was TWG17, “From a study of teaching practices to issues in teacher education”. The group became very big (44 papers and 11 posters presented in 2013). In CERME8, five central themes were identified: studying mathematics teaching; resources for teaching: teacher knowledge and teacher beliefs; teacher education and professional development; teacher collaboration; and teacher reflection (Potari et al., 2013). Given the interest in these topics and the large number of researchers involved, new TWGs

are established after CERME8 in order to deepen the themes that have emerged: TWG18 “Mathematics teacher education and professional development”; TWG19 “Mathematics teacher and classroom practices”; and TWG20 “Mathematics teacher knowledge, beliefs, and identity”.

Since its creation, TWG20 has addressed many issues. In particular, the CERME9 TWG20 discussions focused on teacher knowledge models, their desirability and suitability, as well as their possible uses. Context was an important aspect, as well as the need to clearly define methodological issues, such as the choice of the analytical process, the relationship between theoretical positions and the specificities of the methods used (Ribeiro et al., 2015). Also, in CERME10 TWG20, teacher knowledge frameworks were a protagonist in the discussions, assuming the need to emphasise teachers’ potentials rather than teachers’ deficiencies. Other topics of discussion emerged, in fact TWG20 was organised around three thematic strands: Knowledge in mathematics education, Lesson Study, and teacher knowledge (Ribeiro et al., 2017). In CERME11 and CERME12, the TWG20 group continued to grow. For this reason, it was divided into TWG20A and TWG20B at both conferences. The working sessions at these conferences were characterised by the fact that lot of space was given to collective discussions, giving the participants the opportunity to address general themes that emerged and to use their own research as an example and ground for comparison. Among the transversal issues discussed in CERME11 were cultural aspects and teacher education programmes, teacher educators and tasks in teacher education (Ribeiro et al., 2019). These themes were also addressed and expanded in CERME12, in particular the following topics were the focus of reflection: the role of teacher knowledge frameworks (discussing the importance of the different teachers’ knowledge models and knowledge conceptualizations their use in and for research); the need to pay attention to the specificity of teacher knowledge; the importance for prospective teachers and in-service teachers to discuss and reflect on core teaching practices for the development of their identity and their knowledge; how different definitions and conceptualisations of identity allow for the study of different aspects of teacher identity and change; the relationship between teacher beliefs, culture and traditions (Aslan-Tutak et al., 2022).

### **Present day: CERME 13**

As in previous CERMEs, many of the TWG20 papers and posters were focused on the topic of teacher knowledge, but there was an increase in the number of research on teacher beliefs. Very few of the research presentations had a focus on teacher identity. For this reason, most of the TWG20 discussions were about teacher knowledge and beliefs, related to one or more mathematical areas. In order to share the ideas developed in the small group discussions on the TWG20 papers and posters, we collected participants’ notes using online forms and online note-taking platform, and we devoted a final session to the discussion about the theoretical perspectives, methods and new topics.

In CERME13 we found many of the frameworks already presented in previous CERMEs, such as the Mathematics Knowledge for Teaching (MKT) (Ball et al., 2008), the Knowledge Quartet (Rowland, 2013) and the Mathematics Teachers’ Specialized Knowledge (MTSK) model (Carrillo-Yáñez et al., 2018). Teachers’ knowledge is often intertwined with teachers’ beliefs, as it is made explicit in the MTSK model. Several CERME13 presentations used the MTSK model which includes teachers’ beliefs, to explore the relationship between teachers’ beliefs and teachers’ knowledge. Some

questions that were raised and explored during the CERME13 collective discussions were: What is the relationship between Knowledge of Topics (KoT), Knowledge of Features of Learning Mathematics (KFLM), and Knowledge of Mathematics Teaching (KMT) in the Mathematics Teachers' Specialised Knowledge model (Carrillo-Yáñez et al., 2018)? Can all teachers' insights and understandings be catalogued and assessed? What about tacit knowledge? Is teachers' knowledge a discrete body of knowledge or is it emergent, evolving, and situational? What factors influence teachers' knowledge, beliefs, and identity? What can trigger change in any of these? What are the implications for teacher education?

Despite the increasing number of research studies in the educational literature that investigate preservice and in-service teacher identity development and the factors affecting that process, there were few presentations at CERME13 that focused on this topic, which tends to be approached from a narrative perspective. Instead, many of the studies presented focused on beliefs, in particular exploring teachers' beliefs in relation to the context of complex tasks, epistemological beliefs, beliefs about problem solving, manipulatives and their use, as well as the impact of beliefs about mathematics and teaching on lesson planning. These studies also used quantitative methods from psychometrics. In fact, in this CERME, as compared to previous CERMEs, we have seen an increase in the use of quantitative methods (including methods such as regression and factor analysis) and mixed methods. The submissions to CERME13 showed a variety of methodological approaches into research pertaining mathematics teachers' knowledge, identity, and beliefs. The most common approach to data analysis was various forms of qualitative content analysis of interview data. Papers within this qualitative realm used a variety of techniques within this method from inductive to deductive, but also mixing for developing categories.

### **Looking forward: Some new tendencies identified**

As highlighted in the previous section, several issues have emerged in relation to exploring the underlying tensions between the multiple theoretical lenses and methodologies that can be conceived and used in knowledge, beliefs, and identity research. Some of the key issues and transversal problematic themes that TWG20 would like to develop further include the links between teachers' and prospective teachers' knowledge and beliefs, the development of research on teacher identity - a theme that has been little developed within our TWG during this current edition of CERME - and the connections and relationships between the field of teacher education and research regarding teachers' knowledge, beliefs, and identity. For example, the need to distinguish between tasks for teachers in the field of research and in the field of teacher education arose, as well as considerations of both implementation and task design, in particular, the factors that might be considered relevant to take into account when designing a task were discussed. Consideration was given to what is meant by a 'good' task for teachers and when and how it is considered to be an effective task. As in previous CERMEs, we noted an increase in context-sensitive research and cultural issues emerged in many discussions. Another theme we have collectively discussed is the implicit assumptions that teachers should have a strong specialized knowledge, with a strong and coherent belief system, based on a well-developed professional identity. This implicit assumption led to the metaphor of the "Super-teacher" and to some questions: How much are we demanding to pre-service and in-service teachers? How fair is this demand about preservice and novice teachers, who had not had enough time and

opportunity to reach this maximum-standard? What are the important standards? How helpful (and for whom) is it to conduct research on what teachers do not know?

These issues could be further discussed in the future CERMEs.

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