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# Introduction to the papers of TWG10: Diversity and mathematics education – social, cultural and political challenges

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## SCOPE AND FOCUS

Thematic working group 10 is interested in discussing diversity and mathematics education within the realms of the societal, the cultural, and the political. The working group was established at CERME7 in Rzeszów, Poland, in 2011 (Valero, Crafter, Gellert, & Gorgorió, 2011; see also Pais, Crafter, Straehler-Pohl, & Mesquita, 2013), but was an extension of the language diversity group which had been part of CERME since the first conference.

In the work of the group, mathematics education is assumed to refer to more than the encounter between an individual and a mathematical object and to wider contexts than exclusively classroom settings.

The group is specifically interested in discussing research that addresses how diversity affects possibilities in mathematics education. Diversity might be expressed in terms of gender, ethnicity, language, socio-economic status, disability, qualification, life opportunities, aspirations and career possibilities, etc. Contexts are diverse in terms of the variety of sites where mathematics education takes place, and the differences in the organization and structure of practice in such contexts—schools, homes, workplaces, after-school organisations etc. Contexts also include the political structures where policies are formed that draw on, make use of, or ignore mathematics education research. Diversity also occurs in relationship to who is doing the research and who is being researched, posing methodological issues of an ethical nature. These multiple diversities intersect, and in so doing

pose challenges to intended and actual learning and teaching practices in their multiple forms.

## ORGANISATION OF TWG10'S WORK

In the seminars during CERME9, papers were presented in a similar way to what had occurred in CERME7 and CERME8 in that the authors did not present their own paper. Instead each paper was presented by another author giving a neutral description of the main ideas from the perspectives adopted in the paper. The author(s) then had a few minutes to add to or comment on the presentation, with the possibility of pointing out or emphasising important aspects. The presenter prepared one question/comment for the author, which was discussed in connection to the presentation. In the end of each session, there was time for discussing the presented papers. These discussions firstly occurred in pairs or small groups and then were shared in the whole group. This was done to facilitate the contributions from as many participants as possible to the work of TWG10.

Although the papers in each session were grouped to facilitate discussions about similarities and connections between papers as well as tensions and contradictions, each session was not labelled as such in advance. One consequence of this procedure was that the efforts to thematize the contents of the research presented became a joint process within the group.

A poster session with 6 posters was held in which all presentors had 2 minutes to describe the content of their poster. The poster authors then positioned

themselves next to their respective posters to engage in discussions with group members.

## THE PAPERS DISCUSSED

In this section, we briefly describe the papers from TWG10 following the schedule from CERME9. We address some (dis)connections between each paper and the subsequent paper as examples of the diversity of papers in the group.

In the paper by *Albanese*, ethnomathematical dimensions are adopted as tools for analysing observations of teachers participating in workshops aiming at influencing their conceptions about the nature of mathematics. *Parra-Sánchez* similarly has an interest in ethnomathematics, but not as a tool adopted in empirical research in school, but as a broad focus of the study itself through a literature review. *Parra-Sánchez* problematizes the relationship between researchers and researched communities in the ethnomathematical field and proposes a more symmetrical approach. While this paper has an interest in power relations between the researcher and the researched, the next paper by *Hauge and colleagues* applies an approach where the gap between the researched (master students) and researcher (Hauge as main author) is closer than in much empirical research in a study on how mathematics related classroom discussions may enhance critical citizenship (drawing on Skovsmose).

Similar to Hauge and colleagues, the paper by *Kitchen and colleagues* critically scrutinises quantifications taking place in society, but with another topic in focus. *Kitchen and colleagues* focus on how teachers' assessment practices were largely influenced by the pressures to prepare students for success on the US state's standardized test. *Bagger* similarly presents research where assessment in mathematics was critically investigated. While *Kitchen and colleagues* pay attention to how official assessments affected teachers' practices, *Bagger's* interest is in effects on students, in terms of student positions which were construed drawing on Foucault. *Turvill*, similarly to *Bagger*, has an interest in mathematics education in relation to young students but with a theoretical object of a study on inequalities. *Turvill* examines number sense from the perspectives of cognitive psychology, situated cognition and Bourdieusian social psychology. In the paper by *Lembrer*, the children referred to are younger than in the case of *Turvill*, while also drawing

on sociology, in a study on the relationship between socialisation and mathematics education in Swedish preschools.

*Montecino and Valero* present a theoretical analysis on texts, as does *Lembrer*. While *Lembrer* analysed official documents, *Montecino and Valero* adopt Foucault and Deleuze to explore how discourses in research literature are operating as part of the fabrication of the mathematics teacher as a subject and in the production of truths about them. *Pansell and Björklund Boistrup* also have an interest in the mathematics teacher but with data from communications within a collaborative teacher meeting where one teacher's justification of her professional decision making as part of a socio-political context is analysed and discussed. The teacher's decision making concerned, for example, calculations and this was an interest in the theoretical paper by *Kollosche*. Here, the focus is on connections between calculation and bureaucracy. Adopting a methodology following Nietzsche and Foucault *Kollosche* points out implications for mathematics education. Similar to *Kollosche*, the paper by *Dahl* is theoretical, although *Dahl* takes on a more structural perspective when adopting concepts from Bernstein suggesting how problem solving can be viewed in three different ways: as an ideology, a competence and an activity.

*Dahl* presents a foundation for a methodology for investigations of problem solving in mathematics education. *Norén and colleagues* also pay attention to methodological matters when revisiting their own research with a focus on methodologies for performing research while paying attention to diversity and equity issues, in this case in relation to newly arrived students. In *Radovic and colleagues* as well as in *Norén and colleagues* there is an engagement in the perspective of the students. *Radovic and colleagues* report on the intersection between mathematics identity and the peer positioning of high attainment girls in a particular mathematics' classroom in Chile. Also *Marks* has an interest in students' perspectives and this paper examines questionnaire and interview data to identify pupils' prevailing mindsets in primary mathematics. The findings, where a fixed-trait belief is dominating, are discussed in relation to mathematics education policy and practice in England.

Although having an interest in mathematics education in school, the paper by *Andrade-Molina and*

*Valero* takes on a more historical perspective than Marks when adopting cultural historical strategies (Foucault) to research the functioning of the school geometry curriculum, arguing that school geometry fabricates the scientific minds of the future. Similar to Andrade-Molina and Valero, *Helenius and colleagues* present a theoretically driven analysis. Drawing on Bernstein's ideas about vertical and horizontal discourse their paper raises issues about how the connection to the everyday in problem solving could reduce children's opportunities to learn mathematics.

Similar to Helenius and colleagues, the paper by *Albersmann and Rolka* concerns problem solving. Albersmann and Rolka do not critically examine the everyday context, but use problems with every day contexts when investigating parent-child cooperation in the course of a workshop. A quite different scope has the paper by *Black and colleagues* where the data derive from a mathematician. In this paper, the role of 'others' is explored in one woman's mathematical identity with the role of 'caring' as a cultural resource to identify as a mathematician. While Black and colleagues examine data related to the discipline of mathematics, *Mukhopadhyay and Greer* argue for the necessity of maintaining diversity in all its human forms, including mathematics and mathematics education. Central to this position is respect of the conception of mathematics and mathematics education as human activities, inextricably embedded in forms of life.

### **AN ELABORATION AND PROBLEMATISATION OF INCLUSIVENESS AND QUALITY IN MATHEMATICS EDUCATION**

In TWG10, we agreed that matters discussed within the group were essential, not only for this group but for research in mathematics education in general. In relation to an interest in inclusiveness and quality in mathematics education research, discussions in the papers from TWG10 would be productive for elaborating and problematizing the research of the field, for example, concerning the development of research ethics, or finding productive ways of addressing the situatedness of any research process in mathematics education.

For TWG10, this concerns respect for diversity in a variety of ways, which also is constantly changing. Different demands for ethical responsibility were

discussed, for example, a virtue of respect for participants/collaborators in research, such as teachers and students, when performing research with an emphasis on recognizing knowledge where it is situated; or, going further, the establishment of deepened connections between the researcher and the researched through allowing the researched a true stake in the collaborative development of the research project, thus sounding out political common ground. While TWG10 obviates a fixation of general demands for ethical responsibility, it formulates reflexive controversy as a requirement for mathematics education research that seeks to locate itself within the realms of the societal, the cultural, and the political. A consequence from such a view is an awareness of how the actions by any researcher within the field of mathematics education have political consequences.

In the work of TWG10, labels were discussed as "needing" not to be taken for granted, such as challenging the meaning of "success in mathematics education" or how a student "in need" may be construed. In discussions as well as in papers, the importance of investigating what lies between and behind labels was addressed.

Another theme within TWG10 was an interest to problematize and challenge mathematics education research done with the aim of identifying the teaching and learning practices that "work best". In the discussions within TWG10, the focus shifted from "what works" towards the question of rather „how what works looks like – and for whom“. Furthermore, research within TWG10 addressed how the enforcement of accountability measures within many societies of today is not likely to promote any "deep" mathematical competence.

One such aspect was a discussion in which many of the issues within mathematics education were taken as not only being problems of scenarios of learning mathematics, but issues within the broader political context that still concern mathematics education. Consequently, while some of the papers explicitly established the relation between the local context, for example, a classroom, and the broader political context, discussions steadily established such relations where it was not an explicit focus of the respective papers.

In TWG10, we also identified tensions where perspectives within the group were not coherent. One

such tension was a research interest in the subject of mathematics where mathematics education could be viewed as a gatekeeper where social order should be maintained. In other works from the group, the emphasis in the research rather was on how to invite all students into the discipline of mathematics. This included a discussion about mathematics itself in terms of how useful it may be for the individual, but also for societies as a whole. Different kinds of usefulness, at times not compatible, were discussed, such as mathematics as a problem-solving tool in life, or as a selection device (for example, to higher education).

Closely connected to this tension was a discussion in the group about whether change at all was possible, and in that case how. In some discussions, (mathematics) education was emphasized as a facilitator for changing the world we live in, whereas other discussions had a stronger emphasis on (mathematics) education as being structured by the world, with limited power to be a departure for a change in society. The dynamics of the discussions suggest a reflexive approach towards the relation between mathematics education and the societal structures in which it is embedded.

Similar tensions were discussed at CERME8 (Pais et al., 2013) and during CERME9 more topics were included in the discussions. The diversity of TWG10 is also possible to experience through a sound installation made by the group, the “cacophony” on link: <https://www.dropbox.com/s/id10kp598jkc872/TWG10%20cacophony.m4a?dl=0>

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