An introduction to TWG 28: Collaborative settings in mathematics teacher education

Geoff Wake, Stéphane Clivaz, Paula Gomes, Pernilla Mårtensson, Aoibhinn Ní Shúilleabháin

An introduction to TWG 28: Collaborative settings in mathematics teacher education

Geoff Wake[1], Stéphane Clivaz[2], Paula Gomes[3], Pernilla Mårtensson[4] and Aoibhinn Ní Shúilleabháin[5]

[1]University of Nottingham, Nottingham, United Kingdom; geoffrey.wake@nottingham.ac.uk

[2]Lausanne University of Teacher Education, Lausanne, Switzerland

[3]Instituto de Educação, Universidade de Lisboa, Lisboa

[4]University of Gothenburg, Gothenburg, Sweden

[5]University College Dublin, Dublin, Ireland

TWG28 brought together researchers in collaborative settings in mathematics teacher education. In many instances the settings involved learning or lesson studies. However, there was much diversity in the studies in terms of types of collaborations and who they involved, research methods and the analytical framing of the studies that informed contributions and discussions. We report here an overview of our work and in doing so highlight this diversity and richness across the corpus of contributions to the TWG. Our discussions were wide-ranging and explored the full complexity of researching teaching and learning that is close to professional practice. Here we give the briefest of insights into the depth and breadth of the contributions that fuelled our work, and which have provided much for participants to consider as they take their research forward.

Keywords: Teacher education, collaborative settings, professional development, lesson study.

Introduction

TWG28, Collaborative Settings in Mathematics Teacher Education, was established at CERME13. The group brought together researchers whose work involves, in a range of different ways, collaborative settings in mathematics teacher education: an increasingly popular and important area that is close to the day-to-day practice of teaching and learning in mathematics classrooms. The establishment of this thematic working group builds on an informal network of European researchers that has been working together over a number of years and a recent ICMI study group, as well as a growing wealth of publications, including those focused on learning and lesson studies in mathematics. During the conference, the group focused on twenty-five papers and seven posters that were organised around themes that emerged from the submissions and are used to structure our overview below. Contributions came from fifteen different countries. Given the number of accepted submissions, we divided the work of the group into two parallel sessions, which allowed for more substantial discussion of each author/presenter's work.

Of primary importance across all contributions was the nature of the collaboration, whether it be between teachers, between teachers and others (for example, the researchers), between others not involving teachers (for example between mentors/coaches/professional development leads), and across disciplines (mathematics educators with educators in another discipline). We identified three main settings in which researchers situated their work: continuous professional development or in-

service professional learning, initial teacher education and online settings. Across the papers, we also identified a number of different foci in terms of what researchers were analysing: interactions between collaborators, the different roles of collaborators, teacher practice, teacher knowledge, student learning, students' problem solving, design of artefacts (including lesson plans and tasks used with students), and discussions, including those in classrooms. Finally, some contributions emphasised the use of theoretical frameworks and considered their use critically.

Here, we provide an insight into an emergent typology signified by six headings that we have used to organise and understand the contributions and discussions of the group. We emphasise that this is only one way in which this could have been done and focus here on: the different natures of the collaboration, the contexts in which the research took place and the focus of the research analysis.

Lesson/Learning studies and collaboration between teachers

Lesson and learning studies are clearly one of the most obvious and significant areas of research that attracted contributions to this TWG. Many contributions referred to lesson/learning studies that were influenced in some way by models from either Japan and/or China. Lesson and learning studies are increasingly valued as a way of bringing research close to classroom practice in teaching and learning, as evidenced by the growth of published articles across a range of journals, both specific to mathematics education and more general in focus. There has been a shift from early writing about lesson study that was descriptive of the process to one where the focus of contributions to knowledge are focused on a wider range of different ways.

A number of contributions provided insight into how theoretical framing of studies played an important role in research, both in the development of the study and in the interpretation of outcomes. For example, Asami-Johansson, Otaki and Akamoto, and Cosan drew on the Anthropological Theory of Didactics and the construct of paradidactic situations to conceptualise and analyse lesson studies. Other theoretical approaches included ideas of communities of practice, as in a contribution by Leakey, and drew on ideas of contradictions and conflicts arising from Cultural Historical Activity Theory, as in a contribution by Quaresma & da Ponte. A more open discussion of theorising in relation to the kind of mathematics knowledge for teaching that can be developed through learning studies in teacher education was stimulated by the contribution of Mårtensson. Further, the contribution by Sikko and Ding considered the networking of theories drawing on elements of inquiry-based learning and critical thinking. In combining these two theoretical approaches, this contribution, like others we mention here, highlighted the potential that our theorising can bring to advancing our research of collaboration in mathematics teacher education.

The study by Geisen provided insights into a collaboration between regular school and special education teachers and highlighted issues of expectations of teachers in these different roles as well as the different knowledge and expertise they bring to the learning environment. Similar issues were considered in the study of Fiorentino, Montone and Ricciardiello, who researched the work of teachers in relation to the disciplines of mathematics and chemistry in vocational school. This study drew on ideas of boundaries and boundary objects, a theoretical construct that stimulated our discussions in ways that resonated with other contributions.

Other collaborations

Whilst lesson and learning studies were the focus of many research studies, in other contributions, there were examples of research focusing on other collaborations. For example, the study of Antoine considered a collaborative working group of teachers and science and mathematics education researchers. This research focused on measurement in elementary schools across both disciplines. In a similar way, the study of Haringová and Medová brought together teachers and didacticians as a developmental group exploring mathematical trails for learning outside of the classroom. Two contributors, Jacques and Røsseland, highlighted and worked with variation theory to consider teachers' and students' engagement with mathematics in classrooms in England and Norway. In another contribution, the study of Lajoie, Bacon, Bednarz, Maheux, Saboya, and Hanin considered collaborative and developmental work in which researchers worked with pedagogic counsellors to consider the teaching of problem solving. Studies such as these highlight the complexity of work that supports teaching and learning more widely than the obvious context of classrooms and suggest that a substantial area of curriculum development work is under-researched and deserves more attention than it currently receives.

Teacher knowledge development

Central to the processes under scrutiny was the development of teacher knowledge in a range of different contexts. Such development can be interpreted and theorised in a wide variety of ways and contributions to this TWG reflected this, as research studies covered a range of types of didactical and pedagogical knowledge, often with a specific focus in terms of mathematical topics and the age range of students.

A study that had a focus on a particular curriculum topic was that of De Haan, De Vries, Drijvers and Roorda: in this case, in relation to algebra. Likewise, a contribution by Miguens, da Ponte, and Quaresma provided insights into primary teachers' knowledge in relation to computational thinking. Another study from Portuguese researchers Cardoso, da Ponte and Quaresma focused on the development of the mathematical knowledge of prospective primary teachers working with a group of pupils through lesson study.

Other studies, such as that of Chanudet and Favier, took an approach that explored knowledge construction appropriate to teaching problem solving by considering teachers' collaborative discussions around designing a resource to support their teaching. Many contributions to the TWG used methodologies and analytical methods emphasising the importance of teacher talk in this field of study. A further contribution that highlighted this was that of Clivaz, Presutti, Batteau, Bünzli, Daina, and Pellet. Their dialogic analysis, using mixed methods, pointed to the dynamic nature of teachers' mathematical knowledge for teaching problem solving and its development in the context of a lesson study.

Whilst research reported in the TWG always had mathematics as a central focus, this was, at times, significantly related to pedagogic issues. One such study was that of Faria, da Ponte and Rodrigues, who reported their study considering the orchestration of whole-class discussions.

In-service professional development

Many contributions that used a lesson/learning study approach focused on the professional learning of teachers over a period of time. This learning was organised to effect a change in teaching practices in ways that might better support student learning. The contribution of Andriano, Capone, Manolino, Minisola, and Robutti, for example, explored the development of teacher knowledge in combinatorics through lesson study, with a focus on developing teachers' awareness in both classrooms and in post-lesson discussion meetings.

Nagari-Haddif, Karsenty and Arcavi highlighted aspects of how, when adopting lesson study approaches, careful consideration needs to be given to adaptations that might be needed for local contexts and cultures. They also highlighted the centrality of tasks in teaching and learning. Another study that focused on the outcome of incorporating structured problem solving in lesson study was that of Ni Shuilleabhain, Neururer, Hyland and Sievwright. In this research, they emphasised the importance of teachers' planning and anticipating of classroom discussions, based on students' thinking, within the lesson plan. The study by Harvey pointed to the collaborative design of mediating artefacts, such as video clips, classroom data and scientific articles, as being central to ensuring that teaching might be research- and theory-informed.

The contribution by Wake and Joubert provided some insight into the role of lesson study in a much larger and complex intervention programme. This sought to bring about teacher change, leading to improved student learning outcomes in national tests. Their report of a large-scale randomised controlled trial showed how the isolation of lesson study, as a contributing factor to the programme, allowed them to conclude that it was this element that 'made the difference' to student learning.

Studies such as those we mention highlight the importance of teachers' documentation work. Importantly, they point to how research of the work of teachers in their interpretation and enactment of curriculum in classrooms with their students is a rich site for professional learning and research.

Initial teacher education

Of much concern to many who research in teacher education is the context of initial teacher education, that is, the preparation of prospective teachers for their future work with learners. This context provides some very specific challenges for all participants, as trainee teachers are coming to so many aspects of teaching for the first time and are inexperienced in much of what in-service teachers take for granted.

The study of Vieira and da Ponte highlights, like so many others presented in the TWG, how teacher, and in this particular case, prospective teacher, involvement in collaborative research involves the teacher in researching their own practice in ways that are systematic and beyond what might usually be taken to characterise reflective practice. Their particular study pointed to how the prospective teachers' presentation of their work proved important in their learning. Likewise, the study of Vos and Bølstad considered the dynamics in knowledge creation in the context of initial teacher education, with participants discussing with and explicating to others their experiences. This study specifically pointed to the prospective teachers' recognition of how this mode of learning was quite different to

their previous learning experiences. This is something that many of the studies that contributed to the TWG did not overtly emphasise but which was nonetheless an important feature of their design.

Martins, Duarte & da Ponte refer to key aspects that promoted the development of the prospective teachers' knowledge during the planning phases in three lesson studies. A further study in the context of initial teacher education was that of Fitriana that focused on problem posing and how the complexity of such work, especially for the beginning teacher, in the classroom might be supported by an adapted lesson study programme.

Different roles as the focus of analysis

Many contributions recognised the importance of different roles in collaborative studies. For example, a substantial number of studies recognised that collaborative groups often rely on facilitators who carry out important tasks to ensure that participants are brought together and work collaboratively and effectively. The contribution by Masselin and Artigue refers to the professional development and learning of lesson study facilitators. In their contribution, Gomes, Faria and Martins analyse the actions of the facilitator in the planning phase of two different lesson studies. The study by Presutti analyses the role of the teacher educator on the lesson study milieu and the didactical contract, and the impact of moving from one role to another on prospective teachers' learning.

The contribution of Holden and Ryan considered the role of facilitation from a boundary-crossing perspective and drew extensively on the experiences of working on online Lesson Study which has recently, because of the Covid-19 pandemic, been implemented and researched quite widely. This role of facilitation of collaboration stimulated much discussion and signals a further area rich for future research.

Conclusion

As we stated at the outset of this overview, we attributed each of the contributions to the TWG to a particular theme that emerged across our extensive discussions, but we could have achieved this in many different ways. This is symptomatic of the complexity of the work that surrounds teaching and learning and, indeed, the particular work in collaborative settings that brings together key actors in the teaching and learning of mathematics. We hope that, through the brief acknowledgement of each of our contributions, readers get a sense of the diversity of the group's work and how issues of collaboration, educational settings, mathematics and teacher education underpin the work of all of us. We hope that this brief overview encourages you to read the individual contributions in further detail.