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# Introduction to TWG09: Transforming language-sensitive mathematics education research into papers and posters

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*In pursuing the writing and presenting of ‘autonomous’ conference texts –i.e., conference texts functioning in terms of meaning making on their own–, all authors deal with issues of reduction, transformation and representation of the concepts and contexts of initiation and development of their research. In this introduction, we point to challenges tied to the writing and presenting of language-sensitive mathematics education research for communication in conference formats. We discuss some ideas for the improvement of current guidelines and standardised decisions relative to processes and texts produced within the CERME culture. Drawing on experiences provided through our roles as co-leaders of the ‘Mathematics and Language’ thematic working group (TWG09), along with the insights gained from the TWG09 set of papers and posters on the occasion of CERME11, each of us brings a focus to the discussion of challenges and changes that might be feasible and worthwhile.*

*Keywords: Research communication, conference formats, written and oral languages, language-sensitive mathematics education research, representational challenges.*

## Introduction

In conference papers, but also in journal articles, we often read sentences like “because of space restrictions, we do not show the totality of the interview transcript”, or “the lesson data transcribed has been translated into English”, “the lesson data translated into English have been transcribed”. It is also common to find written research without explanation of, or reference to, the original languages involved in data collection and/or the ways of addressing the transformation and reduction of data into certain written formats. These types of omissions and their implications at many levels deserve discussion in any domain of study. Such discussion is even more relevant in mathematics education research that is largely language-sensitive, regardless of the analytical traditions and theoretical standpoints taken. Indeed, throughout meetings of the ‘Mathematics and Language’ Thematic Working Group of ERME (TWG09), including the most recent meeting at CERME11 in Utrecht, many participants have expressed interest in challenging and improving some of the tacit typical practices when dealing with lesson and interview oral data in papers and posters.

In the following sections, we identify four major challenges around fostering a more language-responsive communication of research work, and propose specific changes and directions that could help in this respect. The two guiding questions that we pose to ourselves are as follows:

- What are some of the challenges of communicating language-sensitive mathematics education research in written and oral conference formats, particularly the CERME format?
- What changes in both the tacit positions of researchers and the written/oral products could improve the communication and understanding of the research reported?

Drawing on the experiences provided by our roles as co-leaders of TWG09, along with the insights gained from the TWG09 set of 28 papers and 2 posters on the occasion of CERME11, each of us brings a different focus to the discussion of challenges and changes that might be feasible and worthwhile. We hope that the sections below will give a sense of how research in the domain of mathematics education and language can inform important reflections for the whole field. Although there is increased understanding of the relevance of language in the various domains of mathematics education research, the point at which language issues are considered in written and oral conference formats is inconsistently reported and sometimes treated as a minor question. In our discussion below, each challenge is based on and arises in a number of papers and posters presented at CERME 11, however, each paper and each poster is only used once to illustrate the points being made.

### **The challenge of original language information**

The papers of Azrou, of Mizzi, of Prediger, Uribe and Kuzu, and of Salekhova and Tuktamishov are examples of work conducted in multilingual classroom settings addressing issues of mathematics education and language diversity. Mizzi provides two-column transcripts with the bilingual lesson data in the source languages, Maltese and English, in one column and the target English language in the other, hence doubling the length of the transcript in terms of space taken in the paper. When confronted with text formats of eight pages, doubling transcripts may require about two-thirds of the totality of the report for data presentation. In the papers of Azrou, of Prediger, Uribe and Kuzu, and of Salekhova and Tuktamishov, transcripts of the Arabic-French, Turkish-German and Tartan-Russian source versions of bilingual talk in the respective lessons are not shown, with all the written pieces of data translated into English, its alphabet and writing direction. Similarly, Ranges and Eikset refer to Norwegian students' home language, while presenting transcripts in English, and Rønning and Strømskag present data of conversations in a planning meeting with teachers of Norwegian schools in English. The use of Norwegian is limited to translating technical vocabulary and occasional incorrect terminology. In their presentations, some of these authors claimed practical reasons for the option chosen and particularly mentioned their willingness to share the original data with those participants who had further interest in their works.

Looking back at the whole set of papers and posters across ERME thematic working groups compiled in the CERME10 Proceedings (Dooley & Gueudet, 2017) and given the space restrictions, it is not surprising that the presence of original languages tends to be avoided with the resulting monolingual bias in the perception, representation and communication of the contexts of research. Any option in this respect is problematic. For those papers that incorporate information of original language with translated language text, accomplishment of space restrictions is not trivial. On the other hand, for all papers that have languages other than English in their contexts of research, translation between languages is not trivial either. At CERME11, in his paper, Sträßer refers to the

many challenges of translating data and ideas from a source language to a target language (see also Geiger & Sträßer, 2015). Overall, we find several examples of papers dealing with the decision of how to communicate in English what is said in the source language. In Chesnais' paper, the discussion refers to French grammatical features of the students' interactions, while the presentation of interaction transcripts and of their interpretation is done in English. This can also be found in Erath's paper, where the focus is on lexical and syntactical means produced in German but are presented and written in English. At the most recent meeting of TWG09, only the papers of Ingram and Andrews and of Postenilcu report work developed in a situation in which the source language of data is English exclusively.

Despite the difference of options being used, over these years the discussions in TWG09 clearly reveal that groups of authors, and in general all participants, consider data in the original languages as relevant evidence, not a technical distraction or tangential to the work we do. Reflections in this respect can be found in Planas, Chronaki, Rønning and Schütte (2015), Planas, Ingram, Rønning and Schütte (2017), Planas, Schütte and Morgan (2018), and Rønning and Planas (2013), among other CERME presentations and publications. The belief that untranslated source data is worthwhile, and that access to it is key, are strongly shared and rooted in our working group. We are very aware that untranslated source material retains a great deal of linguistic information that is of interest and can disappear in translation, with important implications for data analysis, interpretation and results. Importantly, the source languages provide vital information for gaining insight and understanding in multilingual contexts of mathematics education research, as well as for developing critical awareness of the monolingual emphasis under which most research products are shaped in our field.

Furthermore, the body of CERME Proceedings brings up paradoxical situations such as having a paper with the source data in French that is only read in its English translation by researchers who are French speakers or who are proficient in this source language and could therefore have a more comprehensive and direct understanding of the research reported in its original language. For each paper or poster, a number of researchers have the expertise and are able to review material in the original languages. With that in mind, ERME could possibly consider some changes oriented to facilitate access to the source languages without the necessity for a dramatic reduction of the space available for discussion in papers. In the age of technological developments and virtual environments, new arrangements could be made to include a multilingual site for registered access to repositories of source data matched with printable texts in the conference proceedings. Such arrangements would be similar to the practical experiences of what some journals do in the electronic version. This way, after consultation, authors could choose the option of linking their papers to the protected site containing information regarding the materials and texts that can be made available in the data's original languages. By using this option, authors could improve the communication of the research reported in the conference format.

### **The challenge of choosing what data is relevant for the paper**

The current practice of CERME papers is to offer authors who are transcribers the choice of two transcript styles. Either they may use Transcript or Numbered Transcript if the author needs to refer

to specific lines in the text. However, the template does not number lines, it numbers turns. In language and interactional research within mathematics education, there is often a need to be more precise. For example, it is frequently interesting to consider interactions where two or more people are speaking at once, or when their turns overlap, particularly when considering classroom interactions where there are multiple speakers and the data is often messy, such as in the work by Friesen, Schütte and Jung. Gestures, gazes and movements, such as pointing, that occur in social interaction are also often highly relevant to the analysis and these often occur concurrently with the spoken discourse. In these situations, line numbers rather than turn numbers are more appropriate, as well as the potential to use specifically designed transcription systems. Conforming to the transcription styles often results in a reduction of the data that members of TWG9 can present, and in some cases results in the loss of that data in the written presentation, as authors need to rely on their short presentation to share certain features of their data. More flexibility in the transcription formats is necessary if we are to offer closer representations of the language data that we are researching.

Greater flexibility in the transcription formats also implies some reference in the template for authors who choose to emphasize the multimodal nature of the data they work with, and who particularly do not produce verbal representations of gestures, body movements and uses of physical space and material objects, but opt for multimodal transcription systems. With the increasing use of video recording in our research field and the development of newer visual methods and analytical frameworks such as digital ethnography, the question of inserting photos and images in the transcript is very timely. Much of the research in TWG09 combines gestural, visual and verbal data, and hence goes beyond the purely verbal mode. This is the case of the papers by Fyhn and Hansen on how meaning of pattern changes depending upon the objects with which students are familiar and interact with, and by Götze on meaning-related language for understanding multiplication where the language is tightly associated with visual representations. The idea of communication ‘mode-switching’ (Sindoni, 2014), which relates to an important feature of multimodal data, is also present in the paper by Peters regarding learners’ reactions and responses to auditory material from radio podcasts.

Some theoretical traditions (e.g., conversation analysis, corpus linguistics) have a specific transcription system of annotation and coding associated with them where not only line numbers are required. There is a specific font and way of spacing transcripts to illustrate features such as pausing, overlapping speech and concurrent gestures (see the topic of transcription decisions and related representational differences and analytical implications in Ingram & Elliott, 2019). These systems often come with complex notation to indicate not only what was said, but also how it is said and this notation needs to be explained in the paper in order for the reader to make sense of the transcripts, which is another challenge to face in meeting the length requirements. Many of the papers in TWG09 are focusing on how students make sense of the mathematics they are engaging with, and this involves a combination of spoken interactions, written materials, and ways of interacting with objects. The current traditions around the written presentation of papers limit how this data can be shared as well as how much data can be shared. As suggested above, the repository of source data could enable the sharing of video or audio data that is often used during the

presentations. This might also be a solution to the issue around the need to share transcription conventions, as well as offering an opportunity to share longer (multimodal) transcripts or additional transcripts for the interested reader.

### **The challenge of comprehensibility of theory development**

The last two challenges differ in nature to the previous ones since they focus on how to make theory and conceptual development more accessible to the readers and the audience. In the domain of mathematics and language, many researchers are guided by a qualitative-reconstructive methodology and they use methods of qualitative social research in their inquiry design. The aim of many research endeavors is to reconstruct underlying structures and patterns of specialized verbal processes of negotiation through extensive analysis of data and the help of a comparative approach (“constant comparative method” in Strauss & Corbin, 1994, p. 273). Generally, research gaps can be identified and based on these gaps components of local theories or theories with limited scope but high comprehensibility are developed using the processes of conjecture and abduction (Peirce, 1991). In the conference proceedings and oral presentations of TWG09 –presumably similar to what happens in other working groups of CERME– only a small portion of the data can be communicated in form of a transcript. However, a transcript excerpt does not usually display, nor even illustrate with precision, the complex process of theory development. Rather, the process emerges across many structural comparisons within an analysis of constant selection of features, decontextualization to a certain degree, and theoretical abduction. In oral presentations and conference proceedings authors can usually only show the best possible visualization, explanation and synthesis of the developed theories, which are mostly striking examples from instances of data materials.

Some of the papers declare and address the challenge of presenting moving from concrete instances of data to theory development in the short space available. The papers by Sauerwein, by Keuch and Brandt, by Alfaro, by Bednorz, and by Umierski and Tiedemann all include some mention to the complexity of making theoretical development explicit and precise by means of the choice and use of selected empirical material. In some of these papers, the examples mirror the process of gradual theory development with local scope in a limited way and are not as comprehensible as originally intended or expected. The empirical material in the transcripts does not, and cannot, provide a sufficiently clear illustration of the theoretical argument. Cohors-Fresenborg and Mackay, Thurlings, Schüler-Meyer and Pepin, during the time for oral presentation of their respective posters, were reflective about the limits of communicating theory development and conceptual abstraction through the examination of examples. For understanding the concepts in the poster of Cohors-Fresenborg, for example, the relationship between what is observed in the lesson data and the scope of application of the concepts introduced by this author is very important.

For compatibility reasons with future research endeavors, especially from early career researchers, it would be preferable if publications and presentations could give a deeper insight into the cumulative process of theory development. Following the line of suggestions in the previous sections, this could also be made possible through a protected area, where researchers could provide further material for the working group. Thus, the gradual process of theory development for a

certain period of time could be demonstrated and shared. This would include transcripts that are not yet published but were crucial for the forming of the developed theory components in the course of the constant comparative method. Additionally, there would be an opportunity to allow any author including early career researchers who have completed their PhD, to present their research process at the conference and give them the opportunity to publish a longer paper in the protected area. Anyone interested could hand in an 8-page paper, from which some could then be selected to be offered the opportunity to write a longer 'master-paper'. All this would certainly contribute to the generation of more activity and transparency in theory building.

### **The challenge of meeting informed audiences**

The struggle of TWG09 participants to find new ways of expressing an updated understanding of what research on mathematics and language means today, and what the identity features of the domain are, frames the context for this last challenge. On the occasion of CERME11, due to the increase of the group size, a division of TWG09 into participants attending either Group 09A or Group 09B for all sessions was necessary. There were no 'subtitles' for the subgroups; rather, papers and posters were grouped into (usually) sets of threes by the TWG co-leaders, based on a perceived commonality among them. The organizational need for a practical division due to the number of participants, however, brought up a more profound conceptual discussion. Half of the papers had multilingual settings in common and hence, the recognition that a number of papers shared some multilingual specificity and fitted with each other was used in the final grouping. In the end, one language group consisted mostly of papers that considered language, interaction or mathematics within contexts that are (at least overtly) monolingual, as was the case for the paper of Theens (Swedish), and of Farrugia, which describes a context wherein English was used as *lingua franca*. In these studies, the languages of the speakers are (generally) not taken into account, unless the speakers themselves make it relevant. The second language group was then mostly constituted by papers wherein the presence of two or more languages in the mathematics classroom is a key element of the discussion, as were the papers of Schüler-Meyer, Prediger and Weinert (German-Turkish), of Ní Ríordáin and Flanagan (Irish-English), and of Chico (Catalan-Spanish).

While the arrangement appeared to make sense and to 'work', and participants' collaboration ensured that things ran smoothly, during the last day it was suggested that multilingual specificity and interactional foci had been central to both Group 09A and Group 09B. In fact, throughout the working sessions the emergent discussion of the multilingual specificity in the papers presented in each subgroup became somehow problematic. The characteristic of 'multilingual' as being restricted to group languages was unintentionally suggested at some points in the discussions of the two subgroups and hence, the broader interpretation of switching between vocabularies, grammatical constructions, intonations, gestures, and so on was less attended to in one of the subgroups but considered in parallel to multilingualism in the other. For a long time, our group has discussed studies that focus on linguistic challenges faced by students that are not necessarily related to a diversity of 'natural' language systems but generally involve multilingualism in the form of (mode) switching between ways of communicating in mathematics lessons. In his paper at Utrecht, for example, Gíslason presented the linguistic and communication repertoires and challenges faced by students who are low attaining in mathematics. The determination of

operational criteria for splitting TWG9 is not trivial at all and what is difficult indeed is to find labels of conceptual distinctiveness that do not diminish the opportunities for all participants to share their research with the interested audience.

In particular, the challenge of the group size with the subsequent splitting of TWG09 leads to the challenge of allocating the papers and posters for their presentation to the most appropriate audience. The conference format of short presentations does not allow much time for clarification of approaches and meanings that participants in the audience must then infer. What can be a rather comprehensible presentation for an audience, may not be equally comprehensible for an audience unfamiliar with specific theoretical stances and research emphases. With respect to this situation, it seems again important to offer authors the possibility of uploading additional material of their work in a protected site so that other participants can more easily follow the ideas and reasoning both in advance and after the working sessions. It is important, for instance, to know what is involved in the use of common terms like ‘*linguaging*’ that may refer to very different stances and emphases (Shohamy, 2006). As can be attested by the variety of topics addressed by the papers and posters in TWG09, studying language in mathematics education may take many forms of *linguaging*, some of which involve different ‘*natural*’ languages or language systems, while some others are related to the alternation of discursive practices necessary for participation in mathematical activity. The papers by Fetzer and by Albano, Coppola and Ferrari show a kind of *linguaging* focused on written practices of argumentation, with shifts between ‘*natural*’, symbolic and pictorial languages within one language system (German/Italian). Other papers with multilingual lesson data show a kind of *linguaging* placed in the newer tradition of ‘*translinguaging*’ as the act of utilizing one’s full linguistic repertoire (García & Kleyn, 2016). Participants also need to know what is involved in the use of the term ‘*multilingual*’. TWG09 participants are aware that attempting to talk about group languages in the classroom context as separate (or separable) systems is artificial and hence, unhelpful for research purposes, but there may be substantially different ways of consider multilingual specificity in data. Of course, the use of group languages overlaps with the use of classroom- or subject-specific discursive practices, so that ‘*language in the mathematics classroom*’ is a complex area of study with a number of stances and emphases that cannot be introduced in short presentations.

We anticipate that the group size will require organizational measures in the near future. Due to the overlap between general language or discursive elements and the ‘*media of instruction*’ of the classroom, but also to questions regarding the precise meaning for contested terms in the domain, it would be important that the two subgroups find the time to have a joint session. There is a lot of commonality in the theoretical and methodological approaches that all members of the group draw upon or consider in their work, and thus identity distinctiveness should be addressed very cautiously. It will be an internal decision amongst TWG09 participants as to how to utilize the separate and joint sessions, in order to encourage fruitful and deeper discussion; however, it will be equally crucial that the CERME organization allows for the flexibility needed with regard to the organization of sessions as well as the provision of additional information and materials.

## More challenges in what comes next

The idea for this introduction paper began as a response to guiding questions posed to ourselves regarding challenges and revisable options of communicating language-sensitive mathematics education research in the written and oral CERME formats. Attention to these questions has been of help to uncover a number of theoretical and reflective issues behind the intricacies of improving the representation and sharing of our work within the CERME community. In our role of co-leaders we have done our best to become openly critical in bringing together some of the challenges that emerge when addressing the writing and presenting of language-sensitive mathematics education research for communication in conference formats. Despite the focus on, and discussion of, conference formats, we can also learn something important about the heterogeneous nature and theoretical complexity of the activity that goes in TWG09. Some of these many different challenges and approaches to mathematics education research on language will be investigated more closely in the diverse papers and posters that constitute this chapter of the proceedings. Through these papers and posters, we will be able to find out what the authors themselves consider the challenges to be that make a strong case for their studies and professional development as researchers in the domain. The creative dialogue with all their points of view will enrich what we have written in more specific and unique ways.

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