# ERME Column

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### ERME Thematic Working Groups

The European Society for Research in Mathematics Education (ERME) holds a biennial conference (CERME) in which research is presented and discussed in Thematic Working Groups (TWGs). The initiative, which began in the September 2017 newsletter, of introducing the working groups continues here, focusing on ways in which European research in the field of mathematics education may be interesting or relevant for research mathematicians. The aim is to extend the ERME community with new participants, who may benefit from hearing about research methods and findings and who may contribute to future CERMEs.

### *Introducing CERME's Thematic Working Group 9 – Mathematics and Language*

*Group of co-leaders: Núria Planas, Marie Therese Farrugia, Jenni Ingram, Kirstin Erath and Marcus Schütte*

### Perspectives on mathematics and language in Europe

Mathematics and language is not a new domain of knowledge. There has been research in this field for about 40 years (Austin & Howson, 1979) and our group has been contributing in this domain for the last two decades (Planas, Morgan & Schütte, 2018). Thanks to a well-established tradition, we have come to know that language in mathematics is more than the language of mathematics, and language in the mathematics classroom is diverse.

### Language in mathematics is more than just the language of mathematics

Mathematicians have largely recognised mathematics as a language with specific notation, symbols, vocabulary, grammar, syntax, structures, etc. Nonetheless, the mathematics and language connection goes far beyond the production and use of a unique human language with its spoken, written and symbolic forms. Even if we agree to take a linguistic approach to what mathematics is (i.e. a language in many ways), languages other than the language of mathematics are involved and they matter in mathematical learning, teaching and thinking. We learn the language of mathematics through Catalan, Spanish, Maltese, English, German, etc., and we specifically come to learn how to speak and write mathematical Catalan, mathematical German…

In TWG9, we examine language in mathematical learning, teaching and thinking. This includes considering language in many roles: as a medium of instruction, as an epistemic tool and a pedagogic resource, as a learning goal and a learning condition, etc. People learn and think mathematics through one or more languages in interaction with each other, and through engagement with the "mathematics itself". Despite this being rather obvious, the myth of mathematics as an almost 'language-free' curricular area persists. There is also the myth that the more symbolisation involved in the mathematics, the less the dependence on the language of learners in teaching and learning. This belief runs through all levels of education and takes different forms at each level. At university level, for example, there is a strong thought that symbolisation (and visualisation) can supply verbalisation. In line with this belief, many school and university teachers view late arrival learners who are in the process of learning the language(s) of instruction as being ready for the mathematics lessons and their mathematical languages. Research in TWG9 shows, however, that mathematics learning and language learning are integral to each other. Some of the questions that interest us are: What is speaking and writing mathematically in the realm of educational practice? How are mathematical and everyday languages related? What are the connections between teaching language and teaching mathematics?

### Language in the mathematics classroom is diverse

In the mathematics classroom, one expects to find ways of speaking and functioning mathematically. These ways never develop in a context of unicity of language and meaning. Let us take the example of the meaning of fraction, which is foundational to algebra, trigonometry and calculus. Learners, mathematics teachers and mathematicians require human languages other than mathematical language in order to make sense of the diversity of semantic meanings linked to, for example, the symbolic representation $a/b$ or the phrase '$a$ parts of an object divided into $b$ equal parts'. To interpret the sign we pose questions like 'what kind of whole is involved in $a/b$?' or 'is there a unit implicit in the situation of representation of this fraction?'. Here, English (or some other language, of course) is the language for posing the questions; it provides the context of culture that first suggests a meaning for whole, unit and the relationship unit-whole. In a lesson with learners who were asked to "cut 1/3 out of 1/2 of a pizza", some language issues emerged when the teacher wanted them to identify "the new whole after cutting the pizza piece out". One of the learners said that there was not a whole anymore because the pizza was not complete. The teacher addressed the polysemy of whole by bridging mathematical and everyday languages in the lesson. The misconception about the word 'whole' brings to the fore the need to integrate diverse languages in the process toward speaking and writing mathematically. The

meaning of 'cutting' (a fraction out of another fraction of a pizza) as 'calculating' (the fraction resulting from an operation) is not language-free either. Furthermore, the meaning of a fraction as a number on a number line takes words such as 'distance', 'length', 'measurement', 'order' and 'position', while the phrase 'share equally' helps to express the quotient meaning – 3/4 as representing 3 pizzas divided among 4 people. Diversity exists in university classrooms as well, where learners also face the challenge of integrating mathematical and everyday languages and where some of them, if not many, are not fluent in the language of instruction. Given the myth that high symbolisation can supply verbalisation (and hence everyday languages), the challenge for university learners is even more transparent and more difficult.

Overall, we have that (i) *language in mathematics is more than the language of mathematics* and (ii) *language in the mathematics classroom is diverse*. The implications of this view of language for mathematics teaching and learning are enormous. By seeing language learning as integral to mathematics learning, we can interrogate misconceptions that are not necessarily grounded in difficulties with the mathematics but in the pedagogic and institutional lack of attention to the everyday languages through which mathematics is taught and learned. A line of concern in TWG9 is the recognition of the everyday and mathematical languages of learners in mathematics learning and teaching. Instead of thinking of some languages (and their speakers) as 'the problem', we see them as an asset and an opportunity for building richer mathematical practices.

## References

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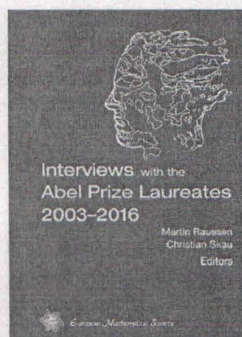
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