CURRENT REPORT

From ‘Vorstellungsübungen’ to ‘exercises in mathematical imagining’: how changing language changes theoretical perspective

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Individual imaginings can be a resource for epistemic processes in mathematics (Giaquinto, 2007) and in mathematics teaching (Mason, 2002). While teaching at the upper secondary level in Switzerland for several years, I have shown that it is possible, by setting appropriate tasks called ‘mathematische Vorstellungsübungen’, to encourage students to use imaginings and their imagination for heuristic and thus epistemic purposes. My practice-based research showed that classroom work with imaginings can be underpinned by theories about mathematics education developed in German-speaking countries (Weber, 2007). In order to introduce this teaching instrument to an English readership, it is necessary to transpose ‘Vorstellungsübungen’ from the German to the English-language context while taking account of differences in the history of ideas and educational theory.

Since Kant and Pestalozzi, the term ‘Vorstellungen’ has been widely used in the German-speaking world. However, no terms within the same semantic field exist in English. Conversely, English terms referring to thinking and imagining resist translation to German. For example, ‘representation’ has both a mental and a physical connotation and may be translated either as ‘Vorstellung’ (when referring to its mental aspect) or as ‘Darstellung’ (when referring to its external aspect), whereas the meanings of these terms in German are mutually exclusive. ‘Vorstellungsübungen’ could perhaps be described as ‘mental imagery tasks’ or ‘visualising tasks’. Both terms, however, are imprecise and potentially misleading. ‘Mental imagery’ calls to mind mental arithmetic and hence a skill to be trained, and evokes the imagery debate in cognitive psychology. ‘Visualising tasks’ likewise has pitfalls, as it emphasises visual modality and is used in the context of constructing graphic images. The term ‘exercises in mathematical imagining’ (or simply ‘imagining tasks’) seems more appropriate (as used by Conway, Doyle, Gilman, & Thurston, 2010, p. 14). This refers not only to the act of forming and manipulating imaginings, but also echoes the instruction “imagine!” that introduces every such task (for an illustrative example see Weber, 2014).

My earlier work was based on an action research approach and investigated the design of imagining tasks and their impact in secondary schools (consisting of five classes with a total of ninety-nine sixteen to twenty-year-old students who had seen ten to forty imagining tasks over a period of half a year to two years). Following educational theories developed in German-speaking countries, I concentrated on evoking and constructing imaginings, and identified their didactic value in the formation of conceptual models concerning meaning,

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referred to as ‘Grundvorstellungen’ (Kleine, Jordan, & Harvey, 2005). Thus my tacit knowing-in-action was made explicit and substantiated, and provided criteria for developing imagining tasks. Amongst these criteria, I recommended putting the imagining processes into writing in order to encourage students to move from their idiosyncratic imaginings to conventional mathematics (Weber, 2007). Although the practice of writing and reflection on writing worked well later in my classroom, it was left undertheorised.

Guided by the German history of ideas, ‘Vorstellungsübungen’ were developed to form idiosyncratic imaginings and conceptual models. Transposing this teaching instrument to ‘exercises in mathematical imagining’ facilitates a semiotic turn, which focuses on the product of the written representation of idiosyncratic imaginings—that is, on inscribing inscriptions (Presmeg, 2006)—and their use. Understanding students’ inscriptions as semiotic signs makes it possible to adopt a more pragmatic and different theoretical view at the same time. For the teacher, the interest now no longer lies merely in the imaginings students should construct, but also in the inscriptions they actually produce. For the researcher, students’ inscriptions can serve as a data base for many investigations: What types of inscriptions do students produce? What use do students make of their inscriptions? What kind of subject-matter content knowledge and pedagogical content knowledge do teachers need to use the inscriptions as a starting point for the following lesson?

In sum, changing language changes theoretical perspective. It suggests that imaginings can be made more productive for epistemic processes via inscriptions, and thus opens a wide field for new research and questions.

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References


