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## The Mathematical Working Space model: An open and adaptable theoretical framework?

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For more than a decade, a theoretical approach focusing on mathematical work in schooling has been developed by an international community of researchers. Grounded on geometry education research, the Mathematical Working Space (MWS) model emerged from this collaborative work and has been developed during symposia, the fifth of which being held in Florina in July 2016. Recent publications in English, French and Spanish (Relime 17(4), 2014; Bolema 30(24), 2016) and in English (ZDM-Mathematics Education 48(6), 2016) may be helpful for discovering this model and its current state.

This poster aims at illustrating and discussing one of the specificities of the model, which means that it was conceived to interact with other approaches. As Artigue (2016, p. 938) underlies:

But the MWS construction is an object of a very different nature, at least in its current state. Its logic seems more that of an assembly that would incorporate, possibly with adaptation, a diversity of constructs and perspectives developed in the field, without privileging any of them. This gives the MWS structure a plasticity that big theories (...) do not have, and certainly contributes to its accessibility and attractiveness.

Conversely, this plasticity and attractiveness pose the challenging question of the real nature of its relationships with other theoretical approaches, which may be grounded on very different epistemological and methodological principles. In this poster our purpose is to address this question through some examples. For that reason, some key-points of the model will be presented and, in particular, how the study of mathematical work in schooling is framed. Then, some examples will be given to illustrate possible interactions with other theoretical and exogenous frameworks. All the examples come from special issues on MWS model and MWS symposia. The list of examples is not complete and other frameworks have been used, although they do not appear in the poster (Didactical Situation Theory, Anthropological Didactical Theory, Semiotic registers, etc.). Naturally, all the examples cannot be considered in detail but the fact that the model is supported on a diagram assists to illustrate interactions. The poster is organized around diagrams showing the findings of the different papers and questioning the openness and adaptability of the MWS model.

**Combining the model with Drouhard's epistemography.** Drouhard's epistemography use has changed the view on tool and instrument in the MWS model (Kuzniak, Nechache & Drouhard, 2016). Depending on their nature and on the way they are being exploited to solve the problem, tools may be situated in any of the three poles of the epistemological plane. In the cognitive plane, one speaks of an instrument whenever a subject interacts with a tool in order to tackle a task effectively. Thus, a tool is associated with a corresponding instrument in the cognitive plane.

**Interactions with Activity Theory.** Hitt, Saboya and Cortés (2016), investigate the articulation between arithmetic thinking and early algebraic thinking, through the analysis of an experiment

which focuses on secondary school students' spontaneous productions. The experiment is conducted within a research methodology based on Activity theory. The MWS model, used as a framework, is here adapted into an 'Arithmetic-Algebraic Working Space' (A-AWS), whose cognitive plane displays an articulation between arithmetic and algebraic thinking.

**Completing APOS theory with the MWS model.** Camacho Espinoza and Oktaç (2016) provide a study, using APOS Theory, on an University teacher in Mexico solving a task in linear Algebra. APOS helps to understand the work at a micro level using the mental mechanism of desencapsulation of an Object into a Process, and the authors use the MWS model to understand the global logic of this work at a macro level.

**Integrating the MWS model in cognition and affect studies.** In a technological (with Dynamic Geometry Software) collaborative setting, Gómez-Chacón, Romero Albaladejo and García López (2016) study the interplay between cognition and affect in geometrical reasoning. Their study integrates the MWS frame to enable a detailed exploration of the transitions from instrumental to discursive geneses of reasoning, within teacher-student and student-student interactions, and also of the cognition-affect dynamics in this process, with a focus on mathematical attitudes.

**Coordinating the MWS and MTSK model to understand teachers' knowledge and the role of the teacher in the classroom.** The MWS model describes the mathematical work development by teachers through the teaching implemented. Carrillo et al. (2016) suggest an articulation between the MWS model and the MTSK theoretical model (Mathematics Teacher's Specialised Knowledge) to emphasize the specific role of Teacher's Knowledge in this learning process.

See the poster: [www.irem.univ-paris-iderot.fr/~kuzniak/publi/ETM\\_EN/2017\\_Cerme10\\_poster.pdf](http://www.irem.univ-paris-iderot.fr/~kuzniak/publi/ETM_EN/2017_Cerme10_poster.pdf)

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