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# The functions of argumentation in mathematics education

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Argumentation can be loosely and generally identified with supporting a claim on the basis of some relevant elements (Aduriz-Bravo, 2014). Thus, it can arguably be said that the general function of argumentation is to establish some degree of certainty –or to remove uncertainty– regarding a claim. However, argumentation’s goals may vary according to the situation (Schwarz, 2009). For instance, in a political debate argumentation is frequently conceptualized as a dispute in which one aims at imposing one’s view over the other’s, even through the use of fallacies or discrediting the adversaries. In contrast, mathematics classroom argumentation is usually associated with collectively arriving at a conclusion on the basis of shared accepted socialized rules and information (Boero, 2011).

Few authors have explicitly addressed the functions of argumentation in mathematics and mathematics education. De Villiers (1990), one of them, pointed out that beyond the predominant function of verifying a claim, proof –a particular form of argumentation– can have the function of explaining, discovering, systematizing and communicating. Other references to the functions of argumentation are traceable as part of the discussion about mathematical activity. For instance, while discussing mathematical truth against Platonism, Davis and Hersh (1983) observe that one of the functions of proof is to test the mathematician’s ingenuity. While describing the aesthetic experience of doing mathematics, Johnsona and Steinerberger (2019) suggest that argumentation has the function of establishing aesthetical criteria in the mathematical community. Within the realm of mathematics education, several researchers suggest that argumentation has the function of making students’ thinking “observable” (Rasmussen & Kwon, 2007), assess comprehension (Schwarz, 2009), facilitate collective learning (Conner et al., 2014) and make pedagogical decisions (Goizueta et al., 2023).

These examples show that different goals relevant to mathematics and to mathematical learning relate to the functions that argumentation plays in mathematical activity. This seemingly simple realization suggests the need to research argumentation from a functional perspective, one that has not been often taken in argumentation research within mathematics education. The questions we ask in the doctoral study we will present at the conference are: what are the functions of argumentation that have been considered –possibly in an implicit way– in the literature? What functions of argumentation are deployed in the mathematics classroom and how do they relate to mathematical learning?

To address the first question, we are conducting a grounded theory literature review (Wolfswinkel et al., 2011) including mathematics education, philosophy of language and argumentation theory in order to consider not just functions that might be directly related to mathematical activity, but also others that might fall within more general approaches to argumentation. To construct the literature corpus, we retrieved articles indexed in WoS and SCOPUS including the term “function\* of argument\*” –or semantically related terms use, role, goal, purpose, aim– in the title, abstract or keywords. The corpus was refined excluding off-topic results and considering relevance to the study through the reading of all abstracts (N=205). We are currently performing an open codification of all

articles to identify references to the functions of argumentation and to perform an emergent cluster analysis to identify major categories that represent the data. The aim of this initial stage is to give a systematic account of the ways argumentation has been approached in functional terms in the mathematics education literature but also in other fields from which different relevant approaches may be adapted to research the mathematics classroom. To address the second question, the results of the initial literature review stage will be the basis for the empirical stage, in which we will identify the functions actually deployed in classroom mathematical activity and explore their relationship to mathematical learning. We hypothesise that mathematical learning is deeply affected by what and how the functions of argumentation appear and are negotiated in the mathematics classroom.

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