

3D DECOMPOSITION AS A SPATIAL REASONING PROCESS: A WINDOW TO 1ST GRADE STUDENTS' SPATIAL STRUCTURING

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3D decomposition is considered a spatial reasoning process (Davis et al., 2015). Spatial structuring is a form of abstraction that creates mental models of shapes' structures (Battista & Clements, 1996). Since early grades, both play an important role in understanding shapes' structures and in learning how to manipulate them flexibly and fluently. 3D shapes have a strong presence in early grades, yet there is still little research about the way students learn their structures. We seek to answer the following questions: How do 1st graders decompose 3D shapes? How are these decompositions related to spatial structuring?

This research is part of an on-going design-based research focused on a 1st grade class's spatial structuring, while exploring 19 tasks concerning 2D and 3D shapes and their representations. Here, we analyse 1st graders' drawings. Local and global structuring were considered as main progression levels in our analysis.

Results show that students decompose shapes by establishing local relationships with flexibility, such as recognizing repeatable or symmetrical composites, without yet coordinate them to form the whole (by omitting or duplicating components); or global relationships, when students coordinate equal or quasi-equal composites, relating them with the whole, flexibly and fluently, and apparently, have a previous mental model that represents the structure of the shape. Students' levels of structuring seem to be influenced by the features of each 3D shapes. Further results will be discussed in detail.

Acknowledgment

This communication was carried out in the scope of Projeto REASON (Projecto IC&DT – AAC n.º 02/SAICT/2017 e PTDC/CED-EDG/28022/2017) and received national funding from the FCT - Fundação para a Ciência e a Tecnologia, IP, within a grant to the first author (SFRH/BD/130505/2017).

References

- Battista, M.T., & Clements, D. (1996). Students' understanding of three-dimensional rectangular arrays of cubes. *Journal for Research in Mathematics Education*, 27(3), 258–292. <https://doi.org/10.2307/749365>
- Davis, B., Okamoto, Y., & Whiteley, W. (2015). Spatializing school mathematics. In B. Davis (Ed.), *Spatial reasoning in the early years: Principles, assertions, and speculations*. (pp. 139-150). New York, NY: Routledge.