

THE ROLE OF THE DOTTED LINE: FROM 2-DIMENSIONAL TO 3-DIMENSIONAL GEOMETRY

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The relationship between the use of artifacts and mathematical knowledge has been studied. Theoretical perspectives such as the *semiotic potential of artifacts* are situated in this line. In this scenario, impact of dynamic geometry environments (DGE) in teaching and learning of mathematics has been recognized. However, the work in this way has been carried out mainly in 2D configurations, with little research in 3D. In this study we analyse the solutions to two problems by one student to find out the semiotic potential of some features of a 3D-DGE. The semiotic potential of an artifact refers to the double relationship that links it to personal and mathematical meanings when used to solve a problem (Bartolini-Bussi & Mariotti, 2008). In our study we used GeoGebra, with an emphasis on its 3D dragging function, and the relationship between the dotted line that evokes the projection of a point on the XY plane when it is dragged and the notion of perpendicularity in 3D.

We analyse the activity of a 11-year-old mathematically gifted student at secondary school when solving two problems of a sequence aimed to introduce objects and relationships in 3D geometry based on their 2D counterparts, where equidistance had a central role. The first author interviewed the student when he solved the problem to know the solution strategy elaborated by him, and the reasons why he considered that this solved the problem. We selected episodes where the dotted line had a prominent role in the student's solutions. An interesting result is that the student used the dotted line unexpectedly to justify the equidistance between objects, showing a connection between this relationship and orthogonality in 3D. Framed in the perspective of semiotic potential and considering our objective, the use to the dotted line suggests the potentialities of this characteristic of GeoGebra with respect to the mathematical meaning of orthogonality. These results contribute to the description of the semiotic potential of tools in 3D-DGE, specifically the unexpected potential of the dotted line, that deserves further investigation.

Acknowledgement

PID2020-117395RB-I00, AEI/10.13039/501100011033, EDU2017-84377-R, ESF Investing in your future

References

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