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Phenomenological analysis of the line: A study based on the Didactical Analysis of mathematical knowledge

Guillermo Ramírez-Montes¹ and Fabián Gutiérrez-Fallas²

¹Instituto de Educação, Universidade de Lisboa, Lisbon, Portugal; grm1905@gmail.com

²Instituto de Educação, Universidade de Lisboa, Lisbon, Portugal; fgutierrez92@gmail.com

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Improving the learning of students has been a concern in research in Mathematical Education. Consequently, didactical aspects and tools for teaching of a successful mathematic, have received a growing attention in different studies. The Didactical Analysis (DA) is considered by Rico, Lupiañez & Molina (2013), as (a) a tool for teaching training; b) an instrument for curricular innovation; and (c) a methodological and research tool, this latter considered in this study. The DA is a cyclic process which implies four sub analysis: content analysis, cognitive analysis, instruction analysis and performance analysis (Gómez, 2002). In the content analysis, we find the Phenomenological Analysis (PA) of a concept, that consist of "describing what are the phenomena for which (the concept) is the means of organization and what relationship has the concept or structure with these phenomena" (Puig, 1997, p.62). Freudenthal (1983) names didactical phenomenology to the phenomenology that is characterized by consider the concept as a cognitive process, as a subject of teaching and to be learned by students, that beside organizes phenomena in the student's world and proposed in the teaching of concept. For this author PA's aims is to serve as the basis for the organization of mathematics teaching.

The intention of this poster is to present results of a PA of line concept on the Cartesian plane, based on the DA of this concept, to answer: what is the knowledge related with the line used for? The data were collected between 2013 and 2014 through a books selection of mathematical and didactics texts of secondary level. The PA of the line was carried out by documental analysis of these texts and its construction was realized in three phases: (i) define mathematical substructures of line concept on the Cartesian plane (mathematical-world), (ii) define the phenomena that each mathematical substructure organizes (real-world), (iii) establish the relationship between substructures and phenomena.

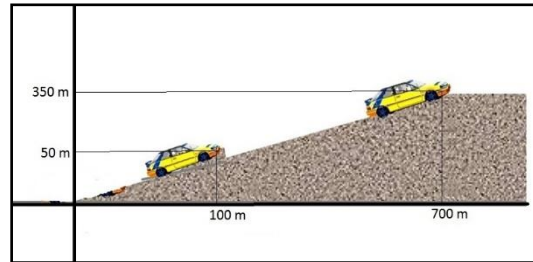
Our proposal consists to show that from this PA, mathematics teachers can organize the teaching of the line on the Cartesian plane promoting the mathematical modelling process of Borromeo Ferri (2006), where phenomena and mathematical substructures are part of different sets, but they are related each other according to the proposed steps in the modelling process. In our study, we identified four contexts that lead to this modeling process, each one referring to phenomena and substructures of how organize the contents of line: (C1) the slope of a linear trajectory with respect to a fixed reference line, (C2) the linear relationship that occurs between two magnitudes, (C3) the behavior between two or more linear relationships, (C4) the distance between two or more objects.

For instance, in C1, a possible real-world model related to the mathematical substructure of the *slope of the line* is as follows:

The picture presents the information of a car when climbing p a road. In this one is showed the position of the car in two different moments, when it has moved 50 m and 350 m respectively.

What is the slope and angle of inclination of the road?

What is the relationship between the slope and the tangent of the angle of inclination?



In relation to C2, a possible real-world model related to the mathematical substructure of *the linear equation of two variables* (or *the equation of two variables of first degree*) is the following:

Carlos has a bank account where he earns 0,5% interest from the initial savings each month. If Carlos opened the account with 2000€ ten months ago, how much money will Carlos currently have? How many months are needed to have 8000€?

In the poster, we would present examples of each context, highlighted the details to consider them like starting points to promote the modelling process in the learning of the line in the Cartesian plane.

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