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# A socially built understanding of rational numbers

Helena Gil Guerreiro<sup>1</sup> and Lurdes Serrazina<sup>2</sup>

1 Universidade de Lisboa, Instituto de Educação, Lisboa, Portugal, [hg@campus.ul.pt](mailto:hg@campus.ul.pt)

2 Universidade de Lisboa, UIDEF, Escola Superior de Educação Lisboa, Lisboa, Portugal, [lurdess@eselx.ipl.pt](mailto:lurdess@eselx.ipl.pt)

*This poster focus on an exploratory study which is part of a research study which aims to understand how to develop students' emerging understanding of rational numbers, at elementary school, looking into how number sense development is promoted, through the use of different representations - percents, decimals and fractions - being the percentage the introductory one. Through a design research, based on a teaching experiment, guided by a conjecture, we intend to analyse the interactions, the strategies and the students' productions when solving tasks. In this poster some data analysis from the exploratory study, concerning the use of percents, will be presented. This data show that percentage seems to be a good starting to introduce rational numbers.*

**Keywords:** Learning, rational numbers, number sense, taken-as-shared meaning.

Rational numbers is a complex content for the development of a sustainable construction of mathematical knowledge (Fosnot & Dolk, 2002). Moss and Case (1999), developed an experimental curriculum to introduce rational numbers where the first topic was percentage, following by two-place decimal numbers and fractional notation as introduced last. Based on this idea, the first author of this poster is developing a design research study, based on a teaching experiment, guided by a conjecture. This conjecture sustains that a detailed and sequenced work with percentage, and the subsequent interrelation with the other representations (decimal and fraction), can be a powerful learning pathway in emerging student's understandings of rational numbers, as they participate in social activity in the classroom and build taken-as-shared meanings, in a number sense development perspective. This conjecture has two dimensions: a mathematical content dimension and a pedagogical dimension.

The first one focuses on a comprehensive concepts' learning construction related with rational numbers, in a perspective of number sense development. Teaching for development of number sense, as Fosnot and Dolk (2002) say, can be seen as the development of powerful strategies, models and big ideas that provide practical, flexible, and efficient computation, to handle numerical problems. The pedagogical dimension is based on a sociocultural perspective, where the construction of knowledge happens in the classroom, through active engagement in communication and interaction. These two dimensions complement each other and allow the study of pupils' learning and its evolution, by articulating a social perspective with a psychological perspective of the learning process (Cobb et al., 2011).

An exploratory study was developed at the beginning of third grade, in a class of 20 students and aimed to identify students' perception on percentage and their intuition regarding proportions. The results show that all the involved students recognize the expression 100% and associate it, in the context of a mobile phone battery, to a "full" battery, that is completely charged. The majority of those students are able to correspond 50% to half. Justifications like "Codfish with 50% discount costs half the price" or "It's 20€ because the jumper was 40€ and since it has a 50% discount it is half-price" reveal that this intuition exists and seems to come about, in some way, associated to the student's experiences, mainly outside school.

Also, in the exploratory study, students were asked to take a stand concerning the statement "More than half of the document is saved!" in a situation where it was possible to see a computer status bar, when 80% of a document would already be processed. Agreement statements like "saving document ends at 100% and half has passed, which is 50%, because it is already in

82%” or “Because the saving document ends in 100% and that has already passed half 100, which is 50 and it is already in 82%” show that most of the students in the classroom reveal some knowledge related to this domain. Other situations presented involved mainly reference numbers and were associated to strong visual models, as percentage bars. It is worth noting that percentage had not been a topic worked in the context of the classroom. Using communication technologies in life creates a set of opportunities that can enhance school learning contexts. The data analyses of this exploratory study pointed towards integrating in school the knowledge built from the use of technologies in life. Percentage makes sense in school because it is part of life. Percentage bars provide a powerful visual concrete representation and can further contribute to build a connection between children’s intuitions about proportions and rational numbers. The purpose is to grasp those experiences and trigger the construction of a knowledge network, towards rational numbers.

The ongoing study will seek to reconstruct episodes of student’s work, in a detailed analysis of the events that took place, guided by the chosen interpretative theoretical framework. This analysis should allow the presentation of student’s understandings embedded in the emergence of taken-as-shared meaning, in the learning of rational numbers, which may provide some clues for research in this area.

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