THE ILLUSION OF LINEARITY: A LITERATURE REVIEW FROM A CONCEPTUAL PERSPECTIVE

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Students' tendency to apply the linear model also in situations where it is not applicable – often called the 'illusion of linearity' – has been frequently described and illustrated in the mathematics education literature. During the last decade, systematic empirical research contributed to our understanding of this phenomenon by providing data on its scale and persistence in different experimental settings (De Bock, 2002). However, the phenomenon of students' improper linear reasoning still suffers from conceptual vagueness, due to the absence of serious attempts to integrate the different aspects of this phenomenon in a broader theoretical framework. Different aspects are, e.g., students' well-known improper 'k times A, k times B' reasoning when dealing with various numerical relations, their tendency to associate the missing-value format of a word problem with a strategy of setting up and solving a proportion, but also their tendency to represent functional relations preferentially by straight lines and their overreliance of the linear properties $f(a + b) = f(a) + f(b)$ and $f(ka) = k\,f(a)$ while simplifying algebraic expressions.

This poster will report the results of a systematic literature review about the illusion of linearity, aimed at providing more conceptual clearness in this phenomenon. Various examples were identified in the literature, showing how the illusion of linearity plays trick to people of different ages and in different cultures, working in diverse domains of mathematics (such as arithmetic, algebra, geometry, probability and calculus) and science. On the poster, we will first show a series of famous historical examples (such as the duplication of the square in Plato's dialogue Meno or the probability problems of de Méré) and discuss how these examples were interpreted by leading scholars in the field. Second, we will elaborate on various examples of utterances of the illusion of linearity mentioned in reports of empirical research and in practical-oriented publications. We will relate the different utterances of this phenomenon not only to mathematical domains or educational levels, but also to the different aspects of the concept of linearity itself and how they may lure people into the linearity trap.

Reference

De Bock, D. (2002). *The illusion of linearity: An empirical analysis of secondary school students' improper proportional reasoning in geometry problems*. Unpublished doctoral dissertation, University of Leuven, Belgium.