SEARCHING FOR THE ILLUSION OF LINEARITY IN PROBABILISTIC MISCONCEPTIONS: A LITERATURE REVIEW
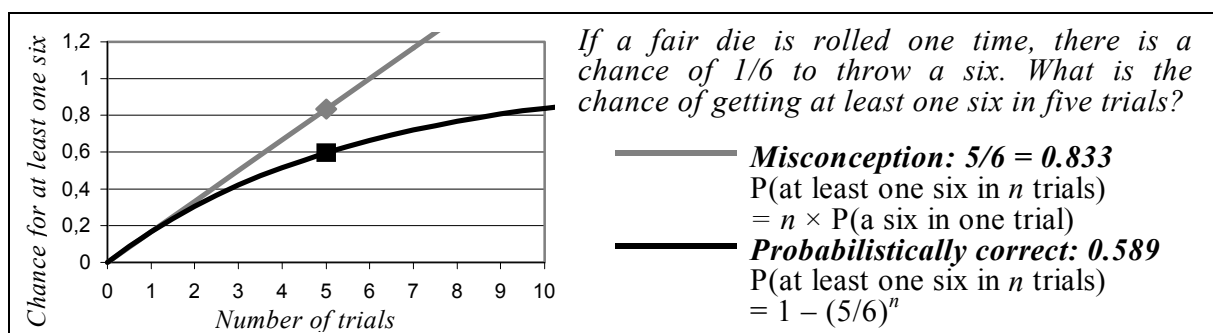
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Recent studies by De Bock, Verschaffel and Janssens (1998) have shown strong empirical evidence for the strength of the tendency among secondary school students to apply the linear (or proportional) model on applied geometrical problems about the relationship between the length and the area/volume of similar geometrical shapes, for which this linear model is not suited. This overgeneralisation of the linear model (the so called 'illusion of linearity') has also been exemplarily described in several other mathematical domains, like elementary arithmetic, algebra and probability, however, without providing much empirical support.

This poster will report the results of a literature survey about the linearity illusion in students' probabilistic thinking. Taking Shaughnessy's (1992) review of the existing research on students' misconceptions about probability as the starting point, the poster represents an overview of those misconceptions that can be conceptually linked to the illusion of linearity.

With respect to each of the six identified probabilistic misconceptions for which such a conceptual link could be established, the poster will show (a) an example of a problem that is expected to elicit the incorrect answer resulting from an overgeneralisation of the linear model, and (b) a graph that shows the wrongly supposed linear relationship between the crucial variables in the word problem contrasted with the probabilistically correct nonlinear relationship. One example is given in the figure below.

If a fair die is rolled one time, there is a chance of 1/6 to throw a six. What is the chance of getting at least one six in five trials?

Misconception: 5/6 = 0.833
P(at least one six in n trials) = $n \times$ P(a six in one trial)
Probabilistically correct: 0.589
P(at least one six in n trials) = $1 - (5/6)^n$

In our future research we will empirically investigate to what extent these probabilistic misconceptions can indeed be attributed to students' tendency to overgeneralise the linear model. This investigation will help us to further unravel some widely known probabilistic misconceptions, on the one hand, and to provide further insight into the range of the linearity illusion, on the other hand.

De Bock, D., Verschaffel, L., & Janssens, D. (1998). The predominance of the linear model in secondary school students' solutions of word problems involving length and area of similar plane figures. *Educational Studies in Mathematics, 35,* 65-83.

Shaughnessy, J. M. (1992). Research in probability and statistics: Reflections and directions. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 465–494). New York: Macmillan.