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Does the confusion between dimensionality and “directionality” affect students’ tendency towards improper linear reasoning?

Lindmeier, Anke M. (ed.) et al., Proceedings of the 37th conference of the International Group for the Psychology of Mathematics Education “Mathematics learning across the life span”, PME 37, Kiel, Germany, July 28–August 2, 2013. Vol. 2. Kiel: IPN–Leibniz Institute for Science and Mathematics Education at the University of Kiel (ISBN 978-3-89088-288-8). 297-304 (2013).

Summary: The aim of this research is to understand the way in which students struggle with the distinction between dimensionality and “directionality” in the context of the relations between length and area of enlarged geometrical figures. 131 third grade secondary school students were confronted with a test consisting of six problems related to the perimeter and the area of an enlarged figure. Results indicate that more than one fifth of the students’ answers were directional, suggesting that students struggled with the distinction between dimensionality and “directionality”. A single arrow showing one direction (image provided to the students) seemed to help students to see a linear relation for the perimeter problems. Two arrows showing two directions helped students to see a quadratic relation for the area problems.

Classification: D73 G33 E53

Keywords: linear reasoning; geometrical figures; length; area; dimensionality; directionality; perimeter; students’ difficulties