ZMATH 2014f.00029

Clements, McKenzie (Ken) A.

Fifty years of thinking about visualization and visualizing in mathematics education: a historical overview.

Fried, Michael N. (ed.) et al., Mathematics and mathematics education. Searching for common ground. Dordrecht: Springer (ISBN 978-94-007-7472-8/hbk; 978-94-007-7473-5/ebook). Advances in Mathematics Education, 177-192 (2014).

Summary: This chapter surveys meanings given to the term "visualization" in mathematics, mathematics education, and psychology, and considers the evidence for the oft-heard assertion that mathematics learners tend to prefer to think algorithmically rather than visually. The analysis reveals that students who do very well on pencil-and-paper "visualization" tests often prefer not to use visual methods when attempting to solve mathematical problems; and those who do not do well on standard visualization tests often describe themselves as "visual thinkers", and prefer to use visual methods when attempting to solve mathematics problems. The influence of various mathematics educators, and especially Alan Bishop – who thought of visualization in terms of a person's use of visual images when posing and solving mathematics problems – of Norma Presmeg, and of a group of mainly Israeli mathematics educators who developed the construct "concept image", is also examined. Views of some mathematicians are also taken into account. In the early 1990s, *W. Zimmermann* (ed.) and *S. Cunningham* (ed.) [Visualization in teaching and learning mathematics. Washington, DC: Mathematical Association of America (1991; ME 1992a.00416)] wrote of how David Hilbert had spoken of two tendencies in mathematics – one that sought to crystallize logical relations, and the other to develop intuitive understanding, especially through "visual imagination". In addressing that theme, *T. Eisenberg* and *T. Dreyfus* [in: Visualization in teaching and learning mathematics. Washington, DC: Mathematical Association of America. 25–37 (1991; ME 1992a.00418)] spoke of mathematics students' preference for "algorithmic over visual thinking". The paper draws special attention to the work of two lesser-known mathematics education researchers, Nongnuch Wattanawaha and Stephanus Suwarsono. It was Suwarsono who devised and applied a method whereby learner preferences for visual or verbal thinking, as well as the "visualities" of the mathematics tasks themselves, could be measured and calibrated on the same scale, using item response theory.

Classification: A30 D20 D40 C30
Keywords: visual image; visualization; mathematics learning; problem solving; item response theory; verbal-analytic processing; visual processing
doi:10.1007/978-94-007-7473-5_11