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Physical and virtual manipulatives: what is "concrete"?

Moyer-Packenham, Patricia S. (ed.), International perspectives on teaching and learning mathematics with virtual manipulatives. Cham: Springer (ISBN 978-3-319-32716-7/hbk; 978-3-319-32718-1/ebook). Mathematics Education in the Digital Era 7, 71-93 (2016).

Summary: We discuss research on both physical manipulatives and virtual manipulatives to provide a framework for understanding, creating, implementing, and evaluating efficacious manipulatives – physical, virtual, and a combination of these two. We provide a theoretical framework and a discussion of empirical evidence supporting that framework, for the use of manipulatives in learning and teaching mathematics, from early childhood through the elementary years. From this reformulation, we re-consider the role virtual manipulatives may play in helping students learn mathematics. We conclude that manipulatives are meaningful for learning only with respect to learners' activities and thinking and that both physical and virtual manipulatives can be useful. When used in comprehensive, well planned, instructional settings, both physical and virtual manipulatives can encourage students to make their knowledge explicit, which helps them build Integrated-Concrete knowledge.

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