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The role of virtual manipulatives in high school students' understanding of geometric transformations.

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Summary: Although there is widespread research that articulates their importance in mathematics education, manipulatives are pushed aside in high school learning settings as something inappropriate or frivolous. The purpose of this study was to identify the role of virtual manipulatives in high school students' mathematical understanding about geometric transformations, which included translations, reflections, rotations, and dilations. The main data sources for this study were semi-structured task-based interviews that were conducted after each weekly transformation lesson. The mathematical understanding of students was analyzed using representation theory and the Pirie-Kieren model. This was presented using a two-dimensional model that shows the students using virtual manipulatives within different levels of mathematical understanding [*S. Pirie* and *T. Kieren*, *Educ. Stud. Math.* 26, No. 2, 165–190 (1994; ME 1995d.02089)]. Results of the study revealed that virtual manipulatives helped students to apply distinct representations of geometric transformations and translate among them. As interventions in the environment, virtual manipulatives strengthened students' mathematical understanding in terms of progressing from inner to outer levels of the Pirie-Kieren model, folding back movements, and acting-expressing activities.

Classification: U70 G50 C30

Keywords: mathematical understanding; virtual manipulatives; representation; Pirie-Kieren model; high school students

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