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Learning about surface area through a digital fabrication-augmented unit.

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Summary: Surface area is consistently identified as a curriculum standard for K–12 students and it regularly appears on national and international assessments. Recently, many schools began acquiring digital fabrication and advanced manufacturing equipment. The growing use of digital fabrication in classrooms raises the question of whether or not this technology can be used to improve students’ understanding of surface area. The specific question we explore in this paper is: How did participation in a digital fabrication-augmented surface area unit affect 5th grade students’ ability to solve surface area tasks? Fifth-grade students used FabLab ModelMaker and die cutters to create three-dimensional cubes and rectangular prisms from card-stock, which were then used during classroom instruction to help students develop conceptual understanding of surface area. Students were assessed with a project-made pretest and posttest, consisting of open-ended tasks. Students showed marked improvements in their ability to complete surface area tasks following the digital fabrication unit. The unit provided students with opportunities to develop effective strategies that allowed them to recognize qualities of three-dimensional figures that cannot be seen in a two-dimensional representation (“Seeing What’s Not Visible”) and to effectively carry out multi-step processes (“Keeping Track”).

Classification: G33 U73 D83

Keywords: surface area; volume; concept formation; educational media; realia; cubes; prisms; digital fabrication; virtual manipulatives; concrete manipulatives; teaching units; experience reports; research; problem solving strategies; invisible faces; student errors