The SSS Theorem: Don't Assume It, Prove It!

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The CCSSM expects students to understand congruence and similarity in terms of transformations and superposition, an approach that's both clearer and more generally applicable than the traditional approach.

Another benefit of the transformational approach is that SAS, SSS, and ASA are no longer postulates: now students can actually prove them!

To take advantage of this opportunity, we need new approaches to transformations and proofs. Proof is been a difficult area for geometry students to master, and almost all of us who teach secondary math today had minimal exposure to transformations during our own high school days.

Constructionism

Richard Feynman said *What I cannot create, I do not understand.* By using Web Sketchpad (WSP) to create transformations and develop congruence proofs , students can develop both a sense of ownership and a deeper understanding of important mathematical concepts such as transformation, congruence, and proof.

Dancing to Understand Transformations

The transformation lessons make use of dance by having students create dances based on geometric transformations and by encouraging them to think of the independent and dependent variables of a WSP "geometric function" as being engaged in a dance as they move about on the computer screen. The concrete aspect of students' physical dance experiences are intentionally "faded" by creating virtual dances using WSP.

SSS Proof as a Construction Problem

The SSS lesson provides students with WSP transformation tools that they use to superpose the image of one triangle on another triangle with all three sides equal in length to the first. The steps of a successful construction correspond to the steps required to prove the SSS Theorem.

Concreteness Fading*

Math-education researchers have shown that students' understanding of abstract concepts is enhanced by connecting those concepts to students' concrete experiences through a process that gradually fades the concrete aspects of the original experience while emphasizing the abstract (usually symbolic) form. By using "concreteness fading" we can help students make important mathematical connections and strengthen their understanding of the target concept.

Presentation web page:
geometricfunctions.org/links/atmopav2018/

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* "The benefits of concreteness fading may be explained by the fact that it starts with a well-understood concrete format, and explicitly links and fades it to the abstract symbols. Concrete materials are advantageous initially because they allow the math concept to be grounded in easily understood, real-world scenarios."
—Fyfe, E. R., McNeil, N. M., & Borjas, S. (2015). Benefits of "concreteness fading" for children's mathematics understanding. *Learning and Instruction,* 35, 104-120.