GIFTS: Matching 2D Engineering Drawings and 3D Objects

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In this Great Ideas for Teaching Students (GIFTS) Paper, the authors present the details of an activity designed to enhance students' understanding of engineering drawing creation and the importance of clear design communication. This activity was used in an Introduction to Engineering Design course, which has ~40 students per section and is typically taken in the first year. In the activity, students are given either a two-dimensional (2D) drawing, or a three-dimensional (3D) object, and are asked to find their matching pair within the class. At first glance, the drawings and components look largely similar, which forces students to look closely at the details of the provided materials. This activity can double as a playful, low-stakes ice breaker, giving students an opportunity to meet classmates in the first few weeks of the course.

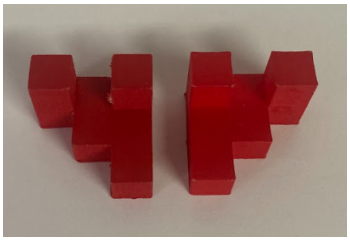

Figure 1: Two 3D objects of the same shape, mirrored

The activity is paired with a lesson on engineering drawings, which covers isometric and orthographic views, and the interpretation of written details on a 2D drawing, including the notes, title block and scale. This activity reinforces that 2D drawings need to showcase the shape of the part, the part material, tolerances, scale, and other design features. The objects in this activity differ in three key ways:

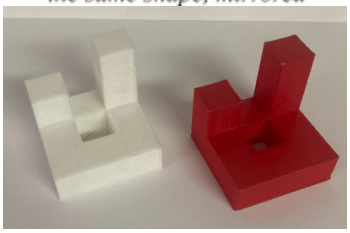

Figure 2: Two 3D objects of the same shape, but different colors

1. *The shape (Figure 1):* The activity includes three base shapes that vary slightly, including mirror image shapes of each base shape. The 2D drawings only provide orthographic projections, so students need to look at multiple views on the drawing to understand the part in all directions. Some students incorrectly matched with the mirror image partner.

2. *The color (Figure 2):* Half of the provided 3D objects are red, and half of the provided objects are white. The 2D drawings specify the material of the part in the top left-hand corner. Students generally correctly matched based on color.

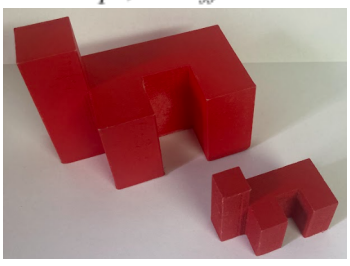

Figure 3: Two 3D objects of the same shape, but at different scales

3. *The scale (Figure 3):* The 2D drawings define the scale of the drawing in the title block. The scale is either 1:1 or 2:1. The scale detail note is small, which encourages students to practice good attention to detail. Students commonly incorrectly matched with the wrong scale.

This activity aligns with previous work [1], which indicates that using physical models can be effective in improving spatial visualization skills. By engaging in this hands-on activity, students develop a deeper understanding of engineering drawings and build skills in carefully analyzing engineering documentation.

[1] Lei Gu. "Using Physical Models in Improving Low Visualizers' Spatial Visualization Skills". 2017 ASEE Annual Conference & Exposition, Columbus, Ohio, 2017, June. ASEE Conferences, 2017. https://peer.asee.org/29085 Internet. 12 May, 2024.