# Plexiglass Cube

## Purpose:

When learning technical drawing and orthographic projection, it is important for students to understand what the three views (in this curriculum, front, top, and right) represent and how they spatially relate to each other and to the object. This manipulative is designed to tangibly demonstrate these relationships.

## Functionality:

### Original concept

An object is fixed inside a clear box and is viewed through the sides of the box. While looking straight through the front panel of the box, a sighted student could trace all visible lines/edges of the object onto the outside surface of the cube, creating an accurate front view of the object. The same process could be repeated looking through the top panel of the box, and again through the right-side panel to create the top and right views, respectively. This helps students practice projecting a 3D object onto a 2D plane. Then the panels of the box can be unfolded into a flat surface, which will place the three primary views in the correct positions relative to each other. Students can examine their tracings and relate their position on a flat surface to their positions on a folded cube.

### Nonvisual adaptation

Instead of students tracing on the outside of the box, pre-made tactile outlines of the front, top, and right views are placed on the appropriate sides of the clear box ahead of time. Also, the left and back panels are cut with large holes so that students can reach in and tactually examine the object while it is inside the box.

To use the manipulative, blind and low-vision students will place one hand inside the box on the object, and the other hand on the corresponding side outside of the box. This allows them to feel both the 2D drawing and the 3D object at the same time and become familiar with their relationship. Once they are comfortable with this, they can unfold the box and feel the three views in the same plane and notice their position relative to each other.

## Construction:

The manipulative consists of five plexiglass panels and a wooden base that together form a cube.

The plans for this manipulative are drawn assuming a 12” cube, made with 1/8” plexiglass, however, the dimensions and materials can be adjusted based on your needs or supplies.

Two of the plexiglass panels are cut with large holes that just leave a 1” border of material around the edge to provide a large opening for students to reach in. The other three plexiglass panels have cut outs of the drawings for multiview block placed on them. These cut outs were originally made using a cricut machine with the <> file. These paper drawings were then affixed onto the plexiglass panels so that the lines of the drawing would be tactually discernable, while keeping the panel clear for students also using vision.

The five plexiglass panels are attached with hinges in the pattern shown in the plans, such that the front panel is in the middle.

The base is made from a thick piece of wood, with a groove around the perimeter, slightly in from the edge. The groove is made such that when the plexiglass panels are folded up into a bottomless cube, the bottom edges of the panels can rest securely in the groove. A post extends up from the bottom of the base to serve as a mount for the object (multiview block) that will be placed inside. As with the other dimensions, the size of this post is specified as ¼“ thick, but this could be larger as long as the hole in the block is adjusted accordingly.

## Graphics:

Page 1: Plexiglass Cube and Base Elevations. Scale 1:4. On the left is the cube on base with hidden dowel line. On the right is the cube shown floating above the base with dowel sticking up. Labels for “cube” and “base” are between the corresponding objects with leader lines leading to each.

Page 2: Cube Components. Scale 1:6. Key showing solid rectangle. Five square panels laid out with hinges connecting them. Each panel is labeled with its part of the cube. Panel edge-to-edge dimensions and interior cutout are noted (12” on exterior edge, 10” for cutout).

Page 3: Base Top View. Scale 1:3. Square base with dimensions labeling length and width and to the center dowel hole. The thin double line inside the square base is the groove.

Page 4: Plexiglass Cube and Base Cross-section. Scale 1:3. Cube cross-section shown floating above base cross-section. Cube and base are both labeled to left. Width of cube matches center of groove to center of groove, 12”. Dowel hole and grooves are labeled with small arrowheads.