# The Relationship between Spatial Visualization Ability and Students' Ability to Model 3D Objects from Engineering Assembly Drawings

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**Summary**

Universities have eliminated many courses in engineering graphics and descriptive geometry over the last 30 years and typically replaced them with a single course that is focused on solid modeling and engineering design. CAD instruction appears to be the main focus of engineering graphics courses that remain, but faculty have many opinions about what is essential when preparing students for careers.

Spatial abilities have been used as a predictor of success in several engineering and technology disciplines. In engineering graphics courses, scores on spatial tests have also been used to predict success. Other studies have shown that an intervention can improve spatial abilities in students who score low on tests in this area.

For this study, the primary research question was, how well do current engineering and technology students read engineering drawings, and is there a relationship between reading engineering drawings and spatial visualization? Can students take the information given on an assembly drawing, visualize or interpret each part, and then create 3D models of the parts in a constraint-based CAD system? Is their ability to do this related to scores on a standard spatial visualization test?

During the Fall 2011 semester, sixty-eight students in two constraint-based modeling courses participated in the study. One course was offered at North Carolina State University in Raleigh, North Carolina and the other course was offered at Riga Technical University (RTU) in Riga, Latvia.

Students were administered an electronic version of the PSVT:R within the Moodle learning management system. Later in the semester students were given the modeling test and asked to model as many parts as possible during the 110 minute class period. Once the data was collected, the researchers evaluated all of the models produced by the students.

The analysis of the data revealed that there is a significant correlation between students' scores on the PSVT:R and their scores on the modeling test. This makes sense since the interpretation of the information in an assembly drawing requires one to mentally manipulate the two-dimensional information given in the drawing, visualize the part in three-dimensions, and then break down the geometry for so it can be reconstructed in the 3D modeling program. One must be cautious not to assume that a high score on the PSVT:R will assure a student will perform well on the modeling test. The scatterplots revealed a positive correlation between the two variables, but they also show many outliers.

The main research question for this study was whether a relationship exists between reading engineering drawings and spatial visualization ability. In this study students who scored higher on the PSVT:R tended to score higher on the modeling test. Although other factors such as symbol recognition and understanding standards and conventional practices influence how well students read engineering drawings, it appears that spatial visualization ability plays a significant role it how well they visualize part geometry.