3D Spatial Visualization: Strategies to Improve Student Success

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Research over three decades has shown that spatial visualization skills are essential for engineering students if they are to be successful in college and in the engineering profession. Before the widespread use of computer-aided drafting (CAD), these skills were taught for many decades as courses called “Engineering Graphics” or “Engineering Drafting”. In these graphics courses, students learned how to visualize, how to sketch, how to letter as well as how to solve problems graphically. With the growth of CAD use, drawing, sketching and drafting skills have declined and, research shows that student proficiency with 3-D spatial visualization skills has also declined. These visualization skills are not acquired with the use/proficiency of CAD tools! However, researchers have developed assessment tools (a 20-minute test, scored by scanner) and the tools (textbook and instruction plan) to teach/learn visualization are available to educators.

In 2009, ninety-two Mechanical Engineering students (all of the sophomores, juniors and seniors) were given the Purdue Spatial Visualization Test of Rotations (PSVT-R) and it was found that the group performed on average well above the level for success in engineering; specifically, 70% of all Mechanical Engineering students scored above the proficiency level score of 85%. No additional action was taken at the time. Two years later, fall semester 2011, during a meeting of faculty (End-of-Course-Review for Mechanics of Materials), it was posited that students were struggling in Mechanics because they lacked these important 3-D spatial visualization skills. A plan was developed and executed during fall semester of 2012; eighty-six sophomores enrolled in Mechanics of Materials took the PSVT-R test and it was found that only 45% scored above the proficiency level.

Swift corrective action has been taken. With abundant support from the Academy administration, we have conducted a developmental course of instruction and exercise activities to improve the 3D spatial visualization skills for those students who volunteered to participate. The institution provided all materials at no cost to students, and faculty volunteered their work as overload levels. The presentation of our results focuses on comparing our actions to those of other institutions as found in the literature review of the subject. Our future plan is also presented in an effort to inculcate the desire for mastering visualization skills and to embed their instruction completely into our entire student program.

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