

Visualization and Spatial Reasoning education in Construction Management Curricula

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The development of visualization and spatial reasoning skills are widely accepted as contributory to a student's success in construction management curricula. Such skills are required in order to "read" and interpret a set of construction drawings. Mastery of such skills may be divided into a sequential pattern of growth: (1) Properly interpret the meaning of lines and symbols depicted on the page; (2) Build an accurate three-dimensional mental image from the two-dimensional configuration of lines and symbols found on the page; (3) Properly visualize the sequence of assembly of the three-dimensional image from its component parts. Construction management educators are tasked with facilitating students' progression through the sequence of visualization skills development. The research conducted for this submission intends to explore the impact of 3D computer modeling as a tool for improving student visualization skills. Although BIM or VDC related courses are not currently offered at this institution, this research may clarify whether the addition of such courses to the curriculum could be contributory to student success in the program.

The objective of this study is to determine whether a correlation exists between visualization and spatial reasoning skills and success in construction management curricula. This study further seeks to determine whether visualization and special reasoning skills can be improved through the use of 3D modeling software and finally, to determine whether accelerated improvement of visualization skills may improve students' overall success in the construction management curricula. This research is currently in progress. By February 2017 nearly all construction management majors of this institution will have taken a baseline spatial reasoning test. The data collected from this test will be controlled for academic level, grade point average, and work experience. Furthermore, a self-selecting group of students are taking a supplementary experimental course specifically designed to strengthen students' visualization and spatial reasoning skills. Working from a set of structural drawings, students will produce (first by hand, then using computer assisted sketching tools) multi-view and isometric sketches of a series of structural details. The selected details increase in difficulty throughout the semester. In all cases, hand-sketching the detail is the students' first attempt at "building" the three-dimensional image. After attempting the sketch by hand, they may progress to building the detail digitally. This sequence encourages students to develop the visualization skills necessary to interpret the drawings and offers digital assistance if they cannot "see" the detail in three-dimensions. The enrolled students will take a visualization test at the beginning and end of the course in order to ascertain whether their visualization skills have improved. In an effort to determine the impact of the course on student learning, the performance of the students who have taken the special course will be tracked in subsequent semesters and compared to the performance of similar students that did not take the course.

Results are expected to demonstrate that early development of visualization and special reasoning skills in students is critical to their success within the construction management curricula. By comparing the performance of the students who took the course with those that did not, and tracking their progress through subsequent classes, an assessment will be made as to the impact of the special course on students' learning. Furthermore, by testing students at the beginning and end of the special course, the researcher intends to determine which teaching methods result in the greatest improvement to students' visualization skills. The intended impact of this research is to develop methods of improving students' visualization and spatial reasoning skills. If successful, the research may be expanded to other institutions, methodologies shared, and further data collected.

Keywords: Visualization, Construction Graphics, Spatial Reasoning