

Geometry in Construction



The Promising Practice

Colorado's CTE programs are seeking to develop a seamless system of education that eases student transitions from one educational system to another and from one level of instruction to another. Data from the Colorado Student Assessment Program (CSAP) and district-wide strategic plan previously indicated a need to improve mathematics skills for all students. Another recognized need was that of reaching out to underrepresented populations—including women, English language learners, recipients of free and reduced-price lunch, special education students, and other minority groups—with quality science, technology, engineering, and mathematics (STEM) education. In Larimer County, construction-related careers account for more than 20% of the private workforce, yet there existed an unmet local demand for construction workers at all levels of the industry. Business and industry representatives from the field who met to discuss the problem stressed the need to hire competent employees who possess solid math skills and a foundation of knowledge in green building techniques, construction, and leadership and employability skills.

In response to identified needs for integrating academic and CTE skills and knowledge, two teachers at Loveland High School in Loveland, Colorado, created and implemented an integrated, contextualized geometry and construction program, Geometry in Construction, in the 2006-2007 school year. Geometry in Construction—geometry taught in the context of construction—is team-taught by mathematics and construction teachers. The content of the traditional geometry curriculum, which is aligned with the National Common Core Standards, was reorganized to allow the geometry concepts to be taught in the sequence required for building a house, the annual capstone event for the Geometry in Construction program. The program is a three-hour block for 9th- and 10th-grade high school students and allows students to learn geometry concepts and immediately apply them in the construction setting while working on completing a home for a local family in need. Students receive credit for both the geometry and construction courses, for a total of two credits (one math and one applied arts elective).

As Geometry in Construction celebrates its fifth anniversary in the spring of 2011, the program is experiencing student engagement and enthusiasm at an all-time high. Students regularly visit the program beyond normal classroom hours for activities like math tutorials and construction sessions; this high level of participation often stems from the excitement students feel about the program and the house-building project. In addition to students' enthusiasm, the community has also embraced the program.

This support has been essential to the success of the integrated curricula. A partnership with Habitat for Humanity for the sale of completed homes has been very successful and allowed students to give back to the community. In addition, many local businesses and industries have contributed building supplies and materials to the program.

Goals

To prepare CTE students to meet the increasing local demand for construction workers at all levels of the industry by increasing mathematics achievement through contextualized geometry and construction courses.

Research Question

How do CSAP mathematics scores of students enrolled in the Geometry in Construction program compare to students enrolled in de-contextualized Geometry courses?

Target Audience

9th- and 10th-grade high school students

Research Design

In Colorado, the CSAP is given to all 9th- and 10th-grade students. CSAP data have been provided for students taking the traditional geometry class

and those taking Geometry in Construction since 2006-2007. Doctoral students from two Colorado universities analyzed the data and provided a report in 2008-2009, with a second report expected to be released in August 2011. The 2008-2009 study compared four groups of students enrolled in the regular geometry course with students in the Geometry in Construction course at Loveland, Berthoud, Mountain View, and Thompson Valley high schools. Honors, Advanced Placement, and International Baccalaureate students were removed from the study groups.

Results

On the geometry and measurement standard of the CSAP in Spring 2009, all of the Geometry in Construction program students who took the CSAP outperformed the regular geometry students, with the Geometry in Construction students all having a rating of advanced or proficient. On the CSAP overall math scores, the Geometry in Construction students scored a mean of 613.8, compared to regular geometry students' mean score of 580.6. The median score for the Geometry in Construction students was 617 compared to the median score of 582 for the regular geometry students. The geometry and measurement CSAP scores were similar, with the Geometry in Construction students having a mean score of 621.5 and a median score of 633.5 compared to the regular geometry students having a mean score of 578 and median score of 590. Additionally, teachers in the Geometry in Construction course noted some positive qualitative gains.

The building part of the program has been very important and enjoyable for students who were less disciplined or less academically inclined. A stipulation was established that homework must be completed in order for a student to participate in building with their teams, resulting in more students seeking extra math tutoring. In addition, teamwork is stressed throughout the course.

Initial enrollment in the Geometry in Construction class was 80 students, and enrollment has increased steadily each year. Current enrollment in 2010-2011

is more than 180 with an anticipated enrollment of 200 in 2011-2012. In its first year, the goal of the program was to have 25% female enrollment. Since the first year, that goal has been exceeded—the program now having reached a 48% female enrollment.

The Geometry in Construction method of instruction has now been used and adapted in several Colorado schools. Additionally, the program and method of instruction has been shared and used in numerous states, including South Dakota, Indiana, Texas, Washington, and Minnesota. Other schools from Montana, Wyoming, New York, and Oregon are planning to begin program training and implementation during the summer of 2011.

Source

Geometry in Construction:
www.geometryinconstruction.org

Other Resources

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Promising practices as a concept has many operational definitions. The NRCCTE approach to this designation is to identify research from reputable sources (e.g., major funded studies, institutional research, district or state analyses of data) and share this with you. Some of the research identified here is a result of very rigorous research (e.g., longitudinal designs with carefully matched samples, experimental designs). However, other studies may not rise to that level of rigor but nonetheless suggest a practice worth examining. We invite readers to follow the links provided and form their own judgments regarding the quality of the research.