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WISEngineering: supporting precollege engineering design and mathematical understanding.

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Summary: Introducing engineering into precollege classroom settings has the potential to facilitate learning of science, technology, engineering, and mathematics (STEM) concepts and to increase interest in STEM careers. Successful engineering design projects in secondary schools require extensive support for both teachers and students. Computer-based learning environments can support both teachers and students to implement and learn from engineering design projects. However, there is a dearth of empirical research on how engineering approaches can augment learning in authentic K–12 settings. This paper presents research on the development and pilot testing of WISEngineering, a new web-based engineering design learning environment. Three middle school units were developed using a knowledge integration learning perspective and a scaffolded, informed engineering approach with the goal of improving understanding of standards-based mathematical concepts and engineering ideas. Seventh grade math students from two teachers in a socioeconomically diverse and low-performing district participated in three WISEngineering units over the course of a semester. Students significantly improved their mathematical scores from pretest to posttest for all three projects and on state standardized tests. Student, teacher, and administrator interviews reveal that WISEngineering projects promoted collaboration, tolerance, and development of pro-social skills among at-risk youth. Results demonstrate that informed engineering design projects facilitated through the WISEngineering computer-based environment can help students learn common core mathematical concepts and principles. Additionally, results suggest that WISEngineering projects can be particularly beneficial for at-risk and diverse student populations.

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