

# Multimodal CS Education Using a Scaffolded CSCL Environment

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## ABSTRACT

There is a growing need for 21st-century workers to be digitally literate and to possess computational thinking and collaborative problem-solving skills. Computer-supported collaborative learning (CSCL) focused on computational thinking can guide students toward the co-development of these skills. In this work, we present our approach to integrating virtual and physical learning modalities into INFUSECS, a CSCL environment. INFUSECS uses problem-based learning scenarios to situate upper elementary school students (ages 8 to 11) in a CSCL setting to foster their computational thinking and science knowledge construction as they collaborate to create digital narratives.

## 1 OVERVIEW

Digital learning environments that include problem-based learning opportunities enable learners to collaboratively “test ideas and solutions, challenge others’ solutions, and engage in dynamic and creative dialogue” [3, p.351]. CSCL models that structure collaborative problem-solving situations for students have been found to be potent pedagogical tools, and to enhance the quality of complex learning outcomes [2], while promoting a shared understanding among students [1, 4].

INFUSECS is designed with built-in scaffolding to support collaborative problem-solving with the end goal of enabling students to create fully functional makerspace prototypes and digital narratives driven by block-based programs. The backstory of the learning environment situates the students with a team of scientists who are stranded on an island after a shipwreck. The students explore virtual locations (in tandem) where they discover and manage resources that can be used in their problem-solving efforts. For example, if a pair of students decide to have the characters in their narrative use a wind turbine to power a rescue signal, the students will use a physical set of maker materials to construct a working model (Figure 1). Depending on which problem-solving challenge students



Figure 1: INFUSECS Collaborative Problem Solving

choose, they need to figure out the degree to which they should collaborate with each other and/or with other teams to make their solutions “work.” Once they have developed a solution they are satisfied with, students are asked to co-construct responses to reflection questions which act as the seeds for a jointly created digital narrative. The final step in their experience involves the students using a block-based coding interface to test and run their narrative programs that allow on-screen characters to act out the problem-solving vignettes they created. This poster presents results from a pilot study with INFUSECS including reports on student collaborative behavior and on student perceptions, interest, and motivation related to CS education in a multimodal CSCL environment.

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