Chapter 10
Cases on STEAM Education in Practice Catapults and History of Catapults

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EXECUTIVE SUMMARY

The catapult was one of the most effective and deadly weapons in medieval siege warfare. They have been critical to warfare since ancient times and have been used by Greek, Roman, and Chinese warriors to vanquish their enemies. This case will present a problem-based scenario where students will assume the identity of an astronaut stranded on Mars. Like the character in the Disney film The Martian, the astronaut only has a small collection of "spare parts" at their disposal. In an effort to fend off predators, they must design and construct a catapult.

LITERATURE REVIEW

Engineering design activities can be a powerful entry point into science learning. Design-build projects are a great way to encourage students to use creativity within projects to tackle a problem (Wicklein, 2006). As students develop an understanding of design-build projects, teachers can challenge them by presenting

Figure 1. Engineering design triangle: next generation science standards, grades 9-12
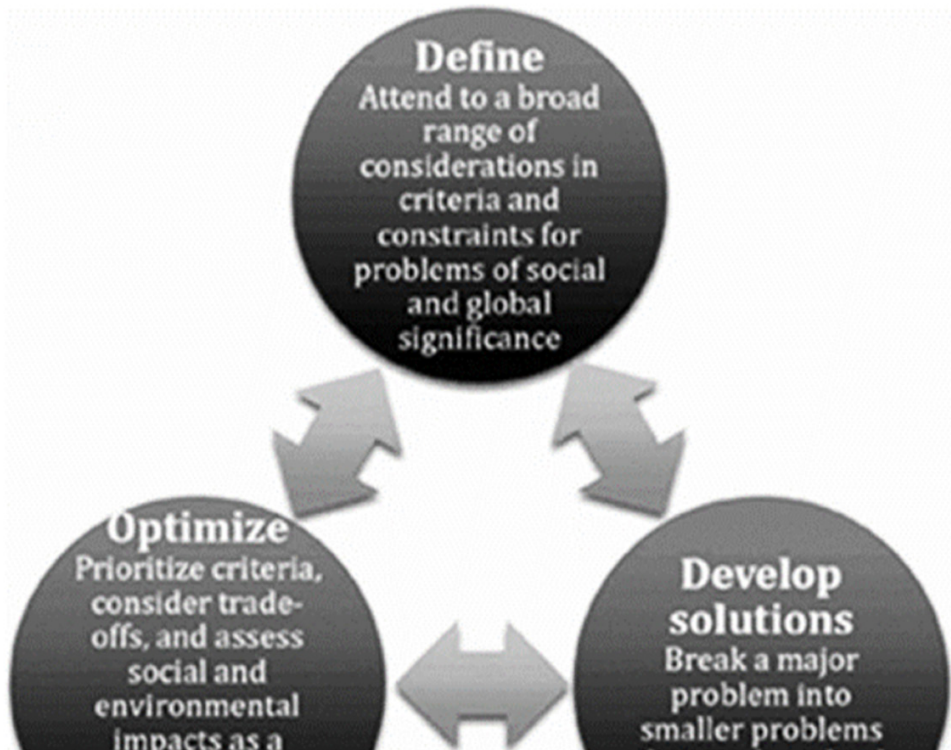
them with a local community-based engineering issue to solve. Selecting a local issue means that it becomes relevant to students. Engineering design-build projects, "hands-on," or "learning by doing" is grounded in constructivist theory (Fortus, Krajcikb, Dershimerb, Marx, & Mamlok-Naamand, 2005) that is shown to improve student achievement in higher level cognitive tasks, such as scientific processes and mathematic problem solving (Satchwell & Loepp, 2002). Current research indicates that when students are given a project-based task, their interest in science, technology, engineering, and mathematics (STEM) can be increased because it requires them to solve genuine, real-life problems (Fortus, Krajcikb, Dershimerb, Marx, & Mamlok-Naamand, 2005). Teachers today are challenged in many ways ranging from administrative tasks to having students reach state mandated test scores. This form of instruction (STEM) provides an engaging methodology that allows the curriculum to be relevant while enabling teachers to provide students with important skills. Students will use critical thinking and problem-solving skills, collaboration, communication, and creativity all while learning required content. The integration of art and engineering embodies creativity. Applying art and design

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