**Staying Alive!**

Mrs. Klein had been teaching engineering to her third graders for two years. She used to have a poster proclaiming: “Failure is not an option!” A year ago, she took it down. She learned that failure *was* an option, especially during the engineering design process (EDP) [Tip 4].

Recently, Mrs. Klein’s students had been learning about the needs of plants and had also read the storybook from the Engineering is Elementary (EiE) unit “Designing Plant Packages” to help prepare for an engineering design challenge (EiE 2011). In this challenge, teams would design a package for a plant that will protect it, keep it healthy for three days and communicate information about its care.

As Mrs. Klein introduced the challenge, she reminded students that they would be working in teams and using the EDP. She engaged students in a discussion about the steps of the EDP, specifically focusing on the Improve step. “Why is this here?” she asked. Students shared that engineers get opportunities to improve their designs, because sometimes their first attempts don’t always work. Mrs. Klein said: “Yes, engineers do their best, but sometimes, their designs fail.” She asked: “Where else have you heard words like *fail* or *failure*? What did those words mean to you?” Students shared experiences from soccer fields, put-downs from siblings and funny statements about “epic fails” from shows and movies [Tip 1].

Ms. Klein reminded the students that in engineering, design failures aren’t negative. Rather, they happen when a design does not meet one or more of the criteria for the challenge [Tip 2]. “For example,” she explained, “your plant package may fail to keep the plant healthy—it might look wilted or brown [Tip 3]. This isn’t a mistake [Tip 5], and it does not mean that *you* failed [Tip 3]; it just means that the design failed. This is important information from the design process to help you figure out how to improve it.”

Throughout the week, teams brainstormed, planned (Figure 1) and finally created their plant package designs (Figure 2). Teams first evaluated how effectively the packages communicated information about the plant. Then, they performed the “shake test” to see how well the package protected the plant, after Ms. Klein demonstrated how to and *how not to* properly conduct the shake test [Tip 6]. The students recorded their results. The plant packages were then left on a shelf in the classroom for the weekend.

The students were eager see how their plants fared over the weekend. Mrs. Klein reminded students to evaluate their plant’s health using the rubric they had developed earlier in the unit (Figures 3 and 4) [Tip 6]. She commented that there was a good chance that some of the plants were not as healthy as they were on Friday, and that some packages may have failed to keep the plants healthy [Tip 7].

There was a mixture of reactions [Tip 8]. One team cheered at the healthy-looking plant inside. Another team was clearly disappointed at the dry, brown leaves of their plant. They sat silent until Mrs. Klein intervened [Tip 10]. She helped them understand that their package had failed to keep moisture inside for the plant. She encouraged them to brainstorm ways to improve their package. At that, the team perked up and began brainstorming.

Another team was disappointed by their wilted plant. But they were also curious. They noticed condensation in the inside of the package. A student exclaimed, “I told you we shouldn’t have used plastic wrap!” Mrs. Klein waited before intervening with suggestions about teamwork. Then, another team member suggested: “Wait, maybe we could still use plastic wrap but poke some holes in it?” The ideas flowed, and Mrs. Klein walked away to help another team [Tip 9]. (Figure 5 shows a team at the end of the process!)

Reference

EiE. 2011. *Thinking outside of the Box: Designing a plant package*. Boston, MA: National Center for Technological Literacy.