Sustainability Learning Objectives for ENES100 Introduction to Engineering Design

Cradle to Cradle Design

An important part of the engineering process is selecting the proper materials for the product application. To teach students the concept of "cradle to cradle design," it will be integrated into the product development and materials selection lectures.

Since the final hovercraft products are typically discarded at the end of each semester, greater initiative to re-use materials from semester to semester will be encouraged and use of sustainable/renewable materials in the hovercraft project will be incentivized.

Assessment: Students will be encouraged with "extra credit" to use renewable materials on their hovercrafts. Also, materials which are salvaged from previous semester projects will be allowed "for free" with no effect on each team's $350 fair market value spending cap.

Biomimetics

Biomimetics – mimicking the engineering designs of nature in man-made engineering applications – is an important part of the bioengineering discipline which can be applied to all engineering disciplines. It has applications for designing the hovercraft for better aerodynamics as well as improved optics and controls. Displaying the benefits this principle can have on improving engineering designs will encourage students to utilize biomimetics in their designs throughout their careers.

Assessment: After presenting students with several biomimetic examples during their design lectures, challenge them on a quiz/homework assignment to apply biomimetics to improve their hovercraft and evaluate whether the biomimetic design performs better or worse than the previous design.

Systems Thinking

Students would benefit from earlier instruction in systems thinking to help them understand the benefit of synergy in their team dynamics and in holistic design of their hovercraft products. Teaching the "interconnectedness and interdependence" demonstrated in sustainability (with the best examples being the codependence of various organisms within ecosystems) can help students understand that their products (and their teams) are a sum of the parts working together. I think this approach will help teams develop better designs and also improved project schedules that take into account the interdependence of various steps.

Assessment: Teams have previously been asked to develop a project schedule (using a Gantt chart or other approved engineering scheduling method) and we vaguely ask them to keep it "updated." I plan to meet with team leaders and their teams on a weekly basis for "schedule update meetings." This will assess students' understanding systems thinking/interconnectedness and interdependence by dissecting what effect delays of various

project steps will have on the overall project and ability to meet deadlines. We will also attempt to create “recovery schedules” to get the project back on track, which will require more knowledge of the interconnectedness of the required future steps.