# Engineering Design & 21st Century Learning

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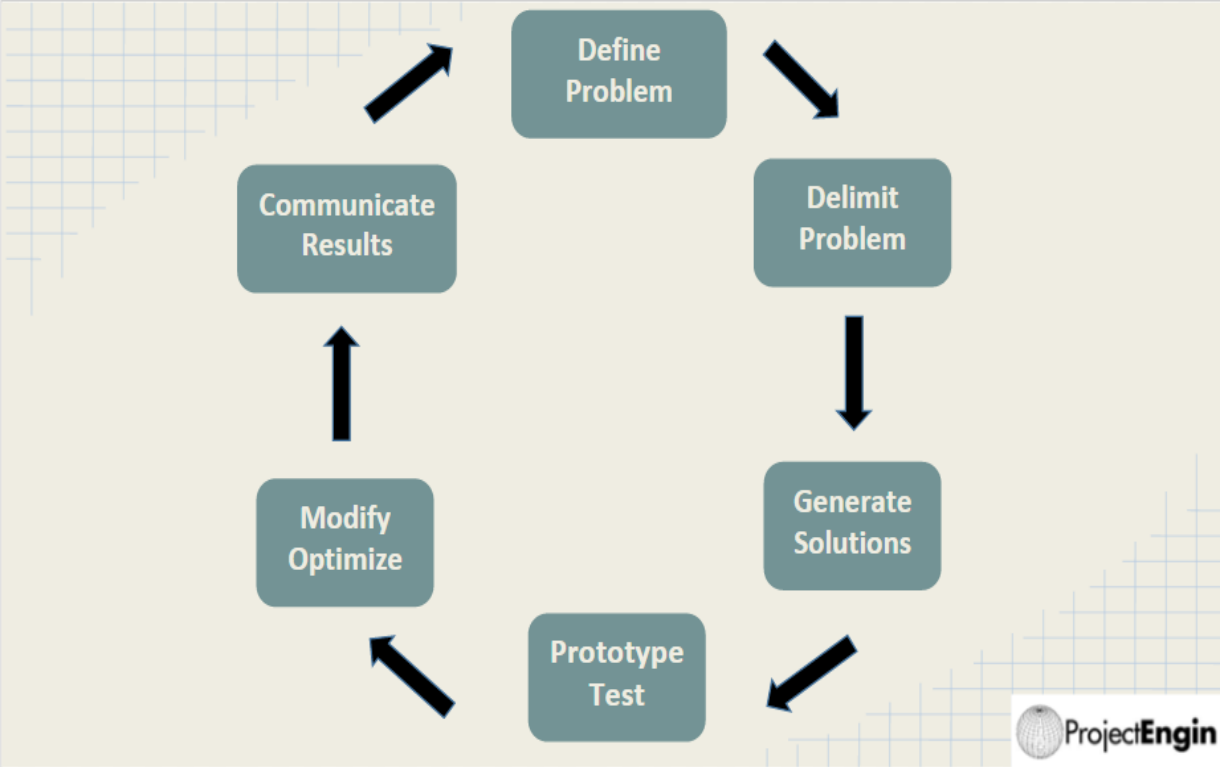
This school year, I have had the opportunity to implement a STEAM enrichment course for our 8th grade students that emphasizes the Engineering Design Process while focusing on life science disciplinary core ideas as well as the practices and crosscutting concepts in the Next Generation Science Standards (NGSS). This course also has a strong emphasis on the 21st century skills of communication, collaboration, creativity, and critical thinking. The 30 day course curriculum was developed by Ann Kaiser of ProjectEngin and was designed to encourage innovative thinking in developing solutions to problems, and highlight the connections, creativity, and collaboration needed for young people to move forward in the 21st century.

During the introductory unit, students engage in several engineering design challenges as they begin to think and work like engineers. The first challenge that they are given is to design a newspaper tower that is free standing, at least 18 inches tall, able to support the weight of a tennis ball, and stand up to the force of wind (from a hair dryer). The students must work together in groups to complete the challenge; however, they are given very limited materials (5 sheets of newspaper, 12 inches of scotch tape, scissors and a ruler) and have only 15 minutes to build their towers. Most groups struggle to find success with this challenge and some students even ask if they are going to fail the assignment because their tower did not meet the requirements. After testing their tower, students must complete a failure analysis and identify what went wrong with their design and then plan for possible modifications that they could make to create a more successful tower. This is where the most important learning occurs for students - when they are asked to analyze their mistakes and design innovative solutions based on their new knowledge. Throughout the course, students work through a variety of engineering design challenges and they quickly realize that failure is an essential part of the Engineering Design Process. As students become more comfortable with failure, they begin to take risks within the classroom and approach design challenges with excitement and creativity. This creates an energy in the classroom that is contagious and ignites learning. I believe that Curt Richardson said it best, “Failure is a part of innovation - perhaps the most important part.”

**The Engineering Design Process**




After completing the unit on Engineering Design, we begin to look at nature as an engineer. Through the lens of biomimicry, students investigate camouflage as nature's way of engineering survivability. As students learn about natural selection, adaptation as a design process and the various types of camouflage found in the natural world, they are working towards the completion of their final design challenge for the course - to develop a camouflage outfit for a wildlife photographer for an environment of their choice. Students work collaboratively as scientists and engineers to research their environment, identify the constraints and criteria that will frame their work, and generate multiple design solutions that could meet the needs of the photographer. As they work together, students are required to document their findings and use this information to inform their final design.

**Student Designs**

This school year has been an incredible learning experience for me as an educator. As I have observed my students embrace failure and work collaboratively to tackle each design challenge, I have been amazed at their level

of engagement, creativity and ownership over their design solutions and I have realized that they have not only learned about the Engineering Design Process and biomimicry throughout this course; they have also learned to take risks, ask questions, work creatively together, investigate ideas, design innovative solutions to real world problems, and communicate results with one another. I believe that these skills are critical to their success in the future. If we hope to produce the future leaders and innovators of the world, then we must provide our students with opportunities to develop the 21st Century Skills of communication, collaboration, critical thinking, and creativity that will provide them with the foundation they need to be successful in college and the workplace. As adults, they will be expected to think creatively, communicate clearly, work well with others, and make judgements and decisions to solve problems. It is our responsibility, as educators, to provide these types of learning opportunities for all students in an effort to help them become successful members of a global community in the 21st century. I truly believe that we, as educators, have the most important job - we help shape the future!