

Engineering Design and Development

ELO Title: Engineering Design and Development

School: Pinkerton Academy

Essential Question:

How can an engineer design a solution to a local, regional or global problem that benefits industry and society?

Area(s) of Study: Engineering

Amount of credit earned: 1

Competencies:

Short description	Full text of competency
Creating a Written Project Proposal	The student will understand the need to justify the selection of a project problem where the need for a solution is balanced against estimated cost, effort, time, and abilities of the designers.
Research and Analysis – Selecting the best solution	The student will understand that multiple design possibilities should be explored in an engineering design process but a single solution path that best reflects the measurable design requirements must be determined.
Design Process	The student must understand the use of problem solving and apply the methodologies and engineering disciplines associated with the engineering design process
Prototyping a solution – Test and evaluate	Prototyping provides the engineer with a scaled working model of the design solution that can be tested.
Redesign and refine – peer review	Engineering design projects are typically peer reviewed. Stakeholder feedback and design reviews help guide engineers through the design process.
Project presentation and Evaluation	A well-done presentation can enhance the perception of the quality of work completed for a team project.

Student Activities (up to 10):

1. Research relevant principles and practices of Science, Technology, Engineering, and Mathematics (STEM) to be used to inform and justify design choices. They should be evident and well documented in an engineering design process.

2. Choose a problem, quantify why it is a problem, and who in fact says this is a problem worth solving with research, surveys and stakeholders to justify the need for a solution to the problem.
3. Determine prior solution attempts to resolve the problem. Research patents, prior art, etc.
4. Develop the criteria and design constraints for the problem based on real need, cost, time required, knowledge required, and mentor/advisors required and available.
5. Construct a written project proposal for your solution, including a Gantt chart timeline and proposed prototype build, including a bill of materials.
6. Design, build, test and evaluate a prototype of the solution. Develop repeatable and reproducible testing methods and document results. Refine design as testing indicates based on original problem criteria and design constraints.
7. Reflect and document the design process to date and create recommendations for possible next steps.
8. Share the testing results and conclusions about the effectiveness of this solution and testing plan with stakeholders and experts related to this project and problem. Gather feedback from stakeholders and experts related to your conclusion and testing analysis.
9. Gather data and information compiled throughout the project and create a project portfolio and presentation of the design solution.

Community Partner:

Manufacturing and engineering firms, college faculty, local businesses, program teachers, mentors, advisors and student parents. Any of these people might be content experts depending on the project.

Community Partner responsibilities in this ELO:

Define overall problem to be solved, assist in data gathering and provide mentorship and materials to help in the solution phase. Provide feedback throughout the selection, design, and testing phases. Critique the final presentation, providing advisory information on cost, timing, presentation, testing parameters, etc.

Assessment:

The final assessment is done via a presentation night to mentors/advisers and manufacturers. The student presents a summary of their design process and an effective technical presentation on the chosen design solution to a group of experts for review. This will include a portfolio summary of the design process utilized. The student defends all decisions made related to the design process utilized.

Parents and mentors complete an assessment rubric that is also used in the final grade component along with the teacher grade of the student's final documentation package which includes a business plan.

Connection to student's measurable postsecondary goals (for students with IEPs):

The project provides a portfolio of documented progress in a capstone project, which can assist in post-secondary education or training.

Comments and suggestions for other schools implementing a similar ELO:

This is a yearlong commitment, and teachers need to assume the role of an advisor providing guidance. Allow students the freedom to determine the project while adhering to the design process. Monitoring all mentor/student interactions. Keep them on track via a timeline, and make sure the design criteria

and solution requirements are maintained throughout the project. Failure is absolutely ok, as long as the students can explain why it failed and what could or should be done to get a more favorable outcome. Documentation of the entire process is a must, and must be submitted to the teacher. A presentation of the outcome is also required in front of stakeholders, mentors, advisors, college faculty, peers and parents.

Willing to be contacted by another school interested in developing something similar to this?

No

Yes. If yes, please list contact information:

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Supporting material included. List and briefly describe:

Presentation posterboard

Project portfolio

Pictures

Evaluation rubrics

Photos or student work submitted:

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