Program Area(s): Technology And Engineering

Lesson Plan Title: E-Racer

Estimated Time: 4-7 days depending on how much time for redesigning.

Primary CTE Pathway(s) Explored: Transportation & Material Moving, Architectural Design (CAD/Drafting), Engineering, Mechanical Design, (CAD/Drafting)

Intended Learning Outcome(s):
- The student will explain transportation technologies and identify types of transportation systems, e.g., land, air and space, marine, pipeline, and conveyor.
- Use the Engineering Design Process to design a transportation device to carry an eraser the length of the track.
- Fail fast and fail often but learn from each failure to create success.

College and Career Awareness Strand and Standard(s):
Strand 8
Students will explore skills, knowledge and concepts related to CTE College and Career Pathways in Technology and Engineering and Skilled and Technical Education.

Standard 3
Explore the careers, education, and training related to engineering, manufacturing, construction, communication, energy, and transportation processes and technologies.

- Explain transportation technology and identify types of transportation systems (e.g., land, air and space, marine, pipeline, and conveyor).

Cross Curriculum Integration:
- Mathematics
  - Solve real-world problems involving two and three dimensional objects
- English Language Arts - Technical reading and writing
  - Career exploration - Write informative text
  - Produce clear and coherent writing
  - Use technology
- Science
- Social Studies
- 21st Century or Soft Skills

Career Opportunities in the CTE Pathway(s): Transportation engineer, aeronautical engineer, aerospace engineer, civil engineer, air traffic controller, pilot, road construction technician, city planner, traffic flow coordinator, marine
Nontraditional Career Opportunities: Transportation engineer, aeronautical engineer, aerospace engineer, civil engineer, air traffic controller, pilot, road construction technician, city planner, traffic flow coordinator, marine captain/crew, conveyor and mining operators, pipeline field technician.

STEM Specific Career Opportunities: Materials science, chemists, physicist, metallurgists, logistics, engineers and engineering technicians, meteorologists

Methods (Approach to Teaching and Learning):
- Direct instruction and demonstration
- Activity/Inquiry/Practice-centered instruction
- Problem-based learning
- Project-based learning
- Experiential or Work-based learning instruction

Materials Needed:
Pitsco AP (Air-Powered) Dragster Launcher
Pitsco AP (Air-Powered) Mini Dragster (Can be shop made easily with a laser engraver and CO2 wheels and axles)
1 paper per student
White glue
Eraser
Worksheet
Pen/Pencil
Powerpoint/computer
Long smooth floor

Vocabulary:
- Land
- Air
- Marine
- Space
- Mass transit Transportation Systems
- Internal Combustion Engine
- Motor
- Potential/Kinetic energy
- Vehicles - Lighter than air/ heavier than air

Prior Knowledge Required by Students:
- Problem solving process
- Simple machines

Instructional Procedures:
1. Use the powerpoint to start a class discussion on What transportation is and the different forms of transportation. Have the students fill out the “follow along” worksheet as you discuss transportation.
2. Pass out the materials for the Dragster.
3. Have the students build the dragster.
4. Pass out the E-Racers Student Worksheet.
5. Review the Engineering Design Process
6. Give the students the following Criteria and Constraints:
   a. Criteria - The dragster must reach the end of the racetrack. The dragster must carry the eraser the whole race. The eraser must be able to be taken in and out easily and quickly before and after the race.
   b. Constraints - Students can only use one sheet of paper and glue to make the cargo area.
7. Students will then complete the E-racer worksheet. First they will brainstorm different ideas. Next they select their best idea and draw an orthographic projection of it. Then they will Build it.
8. Students will next test their E-Racers by launching them with the Pitsco AP (Air-Powered) Dragster Launcher.
9. Have the students fill out the Problem Solving Log and then improve their design.
10. Students then build and test their new design.
11. Have the students repeat as necessary until they are successful or understand why they were not and how to fix it.
12. Have the students debrief their experience by answering the following questions.
   a. How many failures did it take for success?
   b. How did you learn from your failed prototypes?

Preparation

Day 1
1. “What is transportation” Powerpoint and Follow along worksheet.
2. AP Dragster kits.

Day 2
2. E-Racers Student Worksheet.

Day 3
1. Blank Paper for students to build their cargo area out of.

Day 4-7
1. Pitsco AP (Air-Powered) Dragster Launcher.

Additional Resources:
- When using movies and YouTube clips, or videos of this nature, please verify with your LEA’s media policies and/or seek LEA approval to use them.

Assessment(s):
- What is Transportation follow along worksheet.
- E-racer worksheet with Problem Solving Log