Traffic Signals Lesson

Submitted by Wanda F. Bryant, science teacher, Henderson Academy, Detroit Public Schools

Focus Question: What would our world be like without traffic signals?

Lesson Overview: Through a series of activities over 5-7 50-minute class periods, students learn how traffic engineers work to design safe intersections, create hypotheses to evaluate traffic gridlock, evaluate road congestion using level of service (LOS), explain the importance of traffic lights and safety, and research careers in transportation engineering.

Target Grade/Subject: 7th grade Science

Sources & References

Jackson, Mia, Heil, David, Chadde, Joan, and Hutzler, Neil, (2011) *Family Engineering: An Event and Activity Planning Guide*
http://www.its.umn.edu/GridlockBuster/
http://www.teachengineering.org/view_activity.php?url=collection/usf_/activities/usf_traffic/usf_traffic_lesson01_activity1.xml
http://www.teachengineering.org/view_activity.php?url=collection/nyu_/activities/nyu_traffic/nyu_traffic_activity1.xml

Michigan Science Content Expectations

S.IP.07.11 Generate scientific questions based on observations, investigations, and research.
S.IA.17.13 Communicate and defend findings of observations and investigations.
S.IA.07.14 Draw conclusions from sets of data from multiple trials of a scientific investigation to draw conclusions.
S.RS.07.15 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
S.RS.07.16 Design solutions to problems using technology.

Next Generation Science Standards

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

New Vocabulary - list

Procedure

Day 1

Elicit - Brainstorm with students what traffic engineers do. Record responses on overheard or chart paper. Lead students to the understanding traffic engineers are a special type of civil engineer concerned with the safe and efficient movement of people and goods.

Engage - Students watch youtube video on intelligent traffic systems located at http://www.youtube.com/watch?v=XNBIRwyigGM

Explore - Student complete Five Points Traffic Jam activity from Family Engineering book, pages 116-118. After reviewing the engineer design process, students create a rough draft of a safe intersection. The final design is put on a larger map and includes traffic management tools. Ask students to share their proposed designs for a safe intersection.

Homework - Research the history of highway transportation locally and statewide.

Day 2

Elaborate - Students use simulation to work through a series of levels by controlling the traffic and ensuring that delays don't get out of hand—such as lines of backed-up traffic and frustrated drivers—in the simulated environment. Students complete Introduction to Signal Timing, activity 1, Manual Control, Activity 2, Fixed Time vs. Manual Control at http://www.its.umn.edu/GridlockBuster/

Day 3

Explain - Students complete activity 3, Variable Experiments, located at http://www.its.umn.edu/GridlockBuster/ . Students use a template to develop and test hypothesis comparing manual control vs. fixed time.

Homework - Research the history of stoplights.

Day 3

Learning Objectives

- Describe congestion and its levels.
- Calculate traffic density and flow.
- Evaluate congestion through LOS (level of service).
- Identify the impacts of congestion.
- Classify roadways with LOS.

Students construct a model roadway with congestion and apply their knowledge of level of service (LOS) to assign a grade to the road conditions. The roadway is simply a track outlined

with cones or ropes with a few students walking around it to mimic congestion. The remaining students employ both techniques of density and flow to classify the LOS of the track. The lesson can be found at http://www.teachengineering.org/view_activity.php?url=collection/usf_/activities/usf_traffic/usf_traffic_lesson01_activity1.xml

Assessment: Students complete Construction Grading Worksheet.

Day 4

Extend

Lesson Objectives

- Explain the importance of traffic lights and safety.
- Explain and demonstrate the use of light-emitting diodes and resistors.
- Discuss the concept of energy efficiency and how it applies to light emitting diodes.
- Describe two Basic Stamp commands and the loop programming concept.
- Students learn about traffic lights and their importance in maintaining public safety and order.

Using a Parallax® Basic Stamp 2 microcontroller, students work in teams on the engineering challenge to build a traffic light with a specific behavior. In the process, they learn about light-emitting diodes (LEDs), and how their use can save energy. The lesson can be found at http://www.teachengineering.org/view_activity.php?url=collection/nyu_/activities/nyu_traffic/nyu_traffic_activity1.xml

Homework - Research engineering careers at http://bls.gov/ooh/architecture-and-engineering/civil-engineers.htm Students click on tabs to answer what they do, work environment, how to become one, pay, job outlook, similar occupations, and contacts for more information.

Wrap Up - Have students revisit focus question: "What Would Our World Be Like Without Traffic Lights?" and have them write a five sentence response, incorporating ideas learned from each day's activity.