Unit Map 2011-2012

Hampshire Regional School District

Collaboration / Technology 6* (D) / Grade 6 (District Elementary School)

Thursday, April 19, 2012, 2:40PM

Unit: Robotics - Grade 6 (Week 34, 7 Weeks)

Enduring Understandings	Essential Questions
The students will understand that sensors allow robots to interact with the world. The students will understand that engineering design is a iterative process with a defined cycle of steps. The students will understand that failure is an important and valuable part of the engineering process. The students will understand that engineers work cooperatively in teams to accomplish a task.	How does adding a sensor change what your robot can and cannot do? How do you measure the speed of a moving object? How can using the engineering design process help you build a faster robot? How do failures help you create a better robot? What techniques can you use to work cooperatively to accomplish an engineering task?

Curriculum Frameworks and Learning Standards

MA: Mathematics (2011), MA: Grade 6 , Mathematical Practice
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.

MA: Mathematics (2011), MA: Grade 6 , Ratios & Proportional Relationships
6.RP Understand ratio concepts and use ratio reasoning to solve problems.

- 1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
- 2. Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship.
- 3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- 3b. Solve unit rate problems including those involving unit pricing and constant speed.

MA: Mathematics (2011), MA: Grade 6 , Expressions & Equations
6.EE Apply and extend previous understandings of arithmetic to algebraic expressions.

- 2. Write, read, and evaluate expressions in which letters stand for numbers.
- 2a. Write expressions that record operations with numbers and with letters standing for numbers.

MA: Science and Technology/Engineering, MA: Grades 6 - 8 , Physical Sci (Chemistry & Physics)
Motion of Objects

- 11. Explain and give examples of how the motion of an object can be described by its position, direction of motion, and speed.

MA: Science and Technology/Engineering, MA: Grades 6 - 8 , Technology/Engineering
2. Engineering Design

- 2.1 Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.
- 2.2 Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic

- 2.5 Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.

4. Manufacturing Technologies

- 4.2 Explain and give examples of the impacts of interchangeable parts, components of mass-produced products, and the use of automation, e.g., robotics.

6. Transportation Technologies

- 6.1 Identify and compare examples of transportation systems and devices that operate on each of the following: land, air, water, and space.
- 6.3 Identify and describe three subsystems of a transportation vehicle or device, i.e., structural, propulsion, guidance, suspension, control, and support.
- 6.4 Identify and explain lift, drag, friction, thrust, and gravity in a vehicle or device, e.g., cars, boats, airplanes, rockets.

MA: Science and Technology/Engineering, MA: Grades 6 - 8 , Science Inquiry Skills
Skills of Inquiry

- Formulate a testable hypothesis.
- Design and conduct an experiment specifying variables to be changed, controlled, and measured.
- Select appropriate tools and technology (e.g., calculators, computers, thermometers, meter sticks, balances, graduated cylinders, and microscopes), and make quantitative observations.
- Present and explain data and findings using multiple representations, including tables, graphs, mathematical and physical models, and demonstrations.
- Draw conclusions based on data or evidence presented in tables or graphs, and make inferences based on patterns or trends in the data.
- Communicate procedures and results using appropriate science and technology terminology.
- Offer explanations of procedures, and critique and revise them.

Content	Skills
• Gearing down increases the speed of a vehicle • Distance = rate times time • Using multiple trials, increases accuracy in an experiment • Sensors allow robots to interact with their environment • Touch or distance sensors allow a robot to sense obstacles • A robot is a machine that interacts intelligent with its environment in an autonomous fashion • Understand what engineers do in their jobs	• Measure the velocity of a robot car • Build a basic robot car according to pictorial directions • Add a sensor to a basic robot car • Program a robot car to move • Program a robot car to alter its motion when it senses an obstacle • Using gears, increase the speed of the basic car using the engineering design process • Test and refine an engineering design • Discover techniques and parts to add gears to an existing robot car design • Write a definition of robot • Write a definition of engineer

Assessments

Presurvey
Summative: Written: Informative
Define robot and engineer. Students express using a Likert scale, their interest in being and engineer and in using technology.

Postsurvey
Summative: Written: Informative

Formative: Performance: Authentic Task

Students take at least 3 measurements and calculate the speed of their robot car. Student teams turn in the results. Teacher captures the results and displays them on the whiteboard. Discuss accuracy and reasons for differences in results.

Speedy Robot Demonstration

Formative: Performance: Authentic Task

Students demonstrate their faster car, measure, and report on the velocity. Teacher displays results and class discusses differences and how the different designs produced the different results. Students explain their basi design to the rest of the class.

Define robot, define engineering, indicate interest in technology and engineering

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Learning Activities	Resources
• Students build their basic car. This was done in fifth grade. • Students measure the velocity of their car by taking at least 3 measurements of time over a given distance. • Student research, design, build, test, and refine a car that can go faster than the standard car they built. Students research how gears can be used to change speeds. Steering is optional (dragsters). • Optionally, students add a sensor to their car that alters its motion when it senses an object. • As an extension, students can make a program and car that can find its way out of a room.	LEGO Mindstorms NXT Education Base Set LEGO Mindstorms NTX Software LEGO Mindstorms Resource Kit (contains extra parts, wheels, and gears) Kids Engineer Web Site Velocity Checklist (PDF) Grade 6 Challenge Checklist

Last Updated: Thursday, April 19, 2012, 2:40

Atlas Version 7.