



The SPIRIT Project

Educational Robotics

Lesson Building Block Template

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Grade Level: 3-8 Date: Aug 1, 2006

Directions: Directions: Definition of a Lesson Building Block: This is a “Lesson Building Block” from the SPIRIT educational robotics institute. A ‘lesson building block’ is in essence an educational activity that might be later turned into a more formal classroom lesson by a creative teacher. The SPIRIT Institute is striving to put a variety of “lesson building blocks” up on the web for the potential use of teachers as they try to prepare more formal educational lessons using the TekBot robotics platform.



I. Concepts *(Give a list of one or more concepts that might be taught using this activity)*
Problem Solving, Velocity, Math Computation, Spatial Relationships, Technology Tool Application

II. Standards: (Standards for Technological Literacy)

Science:

- 4.6 Science and Technology An understanding of science and technology establishes connections between the natural and designed world, by linking science with technology.
- 8.2 Science as Inquiry Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

Math:

- M 4.2 Computation/Estimation
- M 4.3 Measurement
- M 4.5 Data Analysis, Probability, And Statistical Concepts
- M 4.6 Algebraic Concepts
- M 8.2 Computation/Estimation
- M 8.3 Measurement
- M 8.4.3 By the end of eighth grade, students will understand and apply the formulas to solve problems involving perimeter and area of a square, rectangle, parallelogram, trapezoid and triangle and area and circumference of circles.
- M 8.5 Data Analysis, Probability and Statistical Concepts

Social Studies: (California)

- 4.1.1 Explain and use the coordinate grid system of latitude and longitude to determine the absolute locations of places in California and on Earth.

Technology: Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. (5, 6)

III. Learning Activity Context (Describe the overall context for the learning activity)

Moving TekBot

Abstract:

Students will use Tekbots to travel and create shapes.

3rd grade: will guide the Tekbot through squares. Estimate and calculate perimeter of the square. Probably in Spring 07 as introduction for 4th grade

4th & 5th: How big of a square can the Tekbot make in 60 seconds? Compute average velocity on straight away and turning corner. $60 \text{ sec} = 3x + 4y$ (x time it takes to turn corner). Solve for y (time available for each side.) $y * \text{average velocity per second} = \text{length of each side}$. Test calculations and discuss variables and how they affected the outcome.

6th-8th: After completing exercise above, attach GPS system. Set GPS system to calculate area. Calculate area covered in 60 seconds. Run Tekbot with GPS to test calculations.

IV. Teacher and Student Suggestions/Tips

Pre-teaching: Use nlvm.usu.edu, Virtual Library, 3-5 geometry, Turtle Geometry to familiarize students with necessary movements to complete a square.

Allow students some time to practice with Tekbots before lesson begins

V. Teacher Questions

(Give a list of questions that teachers might ask students during the activity)

If you double the time will the size of the shape double? (Make prediction and test)

If we switched from the concrete parking lot to the grass field, what would change?

What variables affected the outcome? How could you overcome them?

VI. Assessment Ideas

(Give an idea or two about how the lesson activity might be assessed)

Use other shapes and time constraints to check understanding of Tekbot.

Use the record sheets and have each group write up a summary of the results with relationship to velocity and resistance.

Graph results and write a analysis of the results



VII. Other Information

(Give any other information that might be useful or a visual or two)

Try other shapes

Build corners/ mazes to run Tekbots w/o remotes

Try on concrete and grass to judge effects of resistance

Try with weights or pulling objects with Tekbots to compare changes in velocity

Have students calculate speed in mph. Use GPS systems to check calculations.

Have one team plot the outline of a shape using GPS coordinates. The 2nd team follows coordinates to define the shape.

Materials needed: clipboards and pencils, objects of different weights to attach to Tekbots, objects to pull with Tekbots of different sizes and weights, materials to create corners or mazes (wood planks, heavy cardboard, etc.,) GPS systems.

Websites:

<http://www.powersimtech.com/download.html> Free Windows software demo that simulates circuits. Similar to software used in lab at PKI.

http://130.64.87.22/robohabatceo/k12/cgi-bin/activity_index.cgi Lessons designed for Lego Robotics that can be adapted. Includes K-3 engineering lessons.

TV Program: Building the Ultimate Discovery Science Channel Discusses engineering “marvels” (Big Dig, Eurotunnel)

VIII. A materials list