Lesson Title	Robot Turning Lab
Length of Lesson	1 Day
Created By	Dustin Spayde
Subject	Robotics
Grade Level	11-12
State Standards	
DOK Level	DOK 4
DOK Application	Design, Create, Apply Concepts, Analyze, Critique, Connect
National Standards	9-12: A(Inquiry), E (technology)
Graduate Research Element	Developing Automated Systems, Programming

Student Learning Goal:

National Science Education Standards of Content 9-12
A (Inquiry): Identify questions and concepts that guide scientific investigations.
E (Science and Technology): Abilities of technological design: propose designs and choose between possible solutions, implement a proposed solution, evaluate the solution and its consequences, communicate the problem, process, and solution; Understanding about science and technology

Materials Needed (supplies, hand-outs, resources): A Lego Mindstoms NXT kit per 2-3 students, Access to computers (one for each group) with USB ports and the RobotC software (or other compatible language) installed on each, black tape, some disposable cups (or soda cans, etc…)

Lesson Performance Task/Assessment:
Each team will demonstrate their final programs, which should enable their robot to turn 90 degrees with a pivot turn and a point turn. Also they will be challenged to make a curve turn with their robot.

Lesson Relevance to Performance Task and Students:
An automated vehicle such as this could easy be found in many factories and ports around the world. Developing its navigation system is an applicable task for a many engineering fields.

Anticipatory Set/Capture Interest:
Have the instructor make the robot run in a large circle a few times then stop. Ask the class, "How did the robot know to stop where it did?" (Time and/or Distance), "How did the robot know to curve at that particular radius?" (by making both motors move forward at different power settings).

Guided Practice:
Day One: Students will be tasked with making their robots turn in various ways and understanding the mechanics and math of each method. Included in the teacher notes are the methods to be used and the related ideas.

Independent Practice:
Students will program their robot to perform each of the methods. They will present their programs running each of the methods to the instructor for credit. Student will complete a worksheet describing how they completed each method each method.

Remediation and/or Enrichment:
Remediation: individual IEP; partner help throughout lesson; shorten parts of assignment; focus upon smaller elements of the process

Enrichment/Extension:
Set up a seminar in which students explain the design of their programs to the rest of the class.

Check(s) for Understanding:

Day One: As a class can the students list some of the applications for each type of turn?

Closure:

Ask which method is the best and why?

Possible Alternate Subject Integrations:

*Math – can manipulate mathematical expressions to isolate needed variables

*Programming – Basic logic and algorithm models

Teacher Notes:

Pivot Turn: One motor stationary, one motor going forward
Use the motor encoder, wheel circumference, and the wheel base as the turn radius
Point Turn: One motor in reverse, one motor going forward
Use the motor encoder, wheel circumference, and half of the wheel base as the turn radius
Curve Turn: Both motors forward at different speeds
Students should collect data about the turn radius versus motor power ratio