Lesson Title	Robot Driver's License
Length of Lesson	2 Days
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

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 Lego Mindstorms NXT software (or other compatible language) installed on each, multiple measuring tapes/rulers, a small poster board with a large 360 degree protractor drawn in the center (to determine how the robots turns), Black tape, and a few boxes (w/ a min 8" x 11" face).

Lesson Performance Task/Assessment:
Each team will demonstrate their final program, which includes every maneuver learned in the previous steps or goals.

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:
Explain that this is your robot driver's license exam. And that everyone must pass this exam if they want to design their own robots later in the semester.

Guided Practice:
Day One: Supply students with the list of goals (below), and the tools (mearsueing tape, poster board protractor, a piece of the black tape, and access to a box) they will have at their disposal. (The robots should be pre-constructed before this point, instructions are included with the NXT Educational Kit, Sensors needed: ultrasonic, and downward facing light sensor). The instructor will keep a check list for each group with each goal to be checked off (by the instructor) when completed successfully.

Goals:
- Make the robot move a set distance forward (2ft)
- Make the robot move forward until it sees the black tape on the ground (light sensor)
- Make the robot move forward until it sees the box (ultrasonic sensor)
- Make the robot turn 90deg to the right (as precisely as possible)
- Make the robot complete the final course

Day Two: Each team will run the final course until they have completed it successfully. (Some important questions to ask during this time are; "What are the limitations of your design?", "What would happen if the layout of the course changed?", "Would your robot still function properly without going off course? Why or why not?", "How could you improve your design?")

Independent Practice:
Students will be presented with a set of goals and the prebuilt automated vehicles. Students are then split into design teams. Each team is tasked with designing programs that allows the vehicle to complete the goals. Multiple teams can share one robot for testing purposes. Teams will then test each goal in front of the instructor to be marked as completed.

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: Have all teams designed for at least 3 goals?

Day Two: Have all teams completed their designs to navigate the course?

Overall: "What are the limitations of your design?", "What would happen if the layout of the course changed?", "Would your robot still function properly without going off course? Why or why not?", "How could you improve your design?"

Closure:

Day One: Allow the students to work as long as possible, while the instructor browses each group's work to clarify any misconceptions. Finish by informing the students to save their work a being prepared to finish their programming during the next class period. Encourage them to design for the next period outside of the classroom.

Day Two: Discuss with the class which team did 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: