**Instructional Day:** 14

**Topic Description:** Introduce RoboCup real life robotic competition and write instructions for tic-tac-toe.

**Objectives:**

Students will be able to

* Explain how a sequence of game moves can be expressed in simple statements.
* Describe the RoboCup challenge and examine how robots have been programmed to play soccer.
* Develop if-then statements and use Boolean operators to direct a human “robot” to play tic-tac- toe.

**Outline of the Lesson:**

* Tic-tac-toe (10 minutes)
* Robot Competitors Meet on a Soccer Field of Dreams” (25 minutes)
* Instructions for a “robot” to play tic-tac-toe. (20 minutes)

**Student Activities:**

* In pairs, students play a game of tic-tac-toe; then they discuss and write answers to the posted questions.
* Read and discuss the article, “Robot Competitors Meet on a Soccer Field of Dreams”.
* In pairs, students write a series of clear instructions for a “robot” to play tic-tac-toe.

**Teaching/Learning Strategies:**

* Before students enter the classroom, write the following on the board or chart paper: “Play a game of tic-tac-toe with your partner. Then think about these questions together, and write your answers: What are the rules of tic-tac-toe? What decisions does a player need to make before taking a turn? How would you verbally describe each of these decisions? What is the action a robot would need to take based on the decisions?”
* After a few minutes, have students share some of their responses. Make a list of the rules of tic- tac-toe on the board. Ensure students remember that if statements and conditionals are required to describe the moves of the game. Collect the written responses to the warm up activity.
* Distribute the article “Robot Competitors Meet on a Soccer Field of Dreams” and have students read it.
* Lead a discussion about the article.
* Explain to students that they will be working in pairs to write an application for human “robots” (students will act as the robots) to enable them to play tic-tac-toe. The following day will be the RoboTicTacToe Challenge. Remind them of the earlier discussion of tic-tac-toe. What goals does each player have? Who starts the game? Is there a “best place” to put the first X? What are some winning strategies for the next move? For example, If the X is in the center, then where should an O be placed? Why is “if-then” logic a good way to explain strategy for a simple game like tic-tac-toe? How can Boolean operators, and/or/not, help simplify the commands?
* Demonstrate the opening move for a game of tic-tac-toe on the board. Draw a nine-space grid and label the squares one through nine. Then ask students where to place the first X. Depending on where it is placed, have students create an if-then statement that determines the next move. For example, “If the first X is in the center, place an O in a corner square.”
* Ask students to complete the instructions. Each instruction in the entire sequence will cover every possible combination of moves the students can think of until a game is completed. Students need to remember that there are multiple options for each move (including the beginning move). They should consider all of the possibilities in developing their code. They also need to consider what the behavior the robot will exhibit based on the instructions provided.

Note that the focus in this lesson is really a reinforcement of programming as a set of instructions in the context of something most students understand. The game of tic-tac-toe is not a natural example of robotics because robot environments are generally dynamic with infinite possible states of the environment.

**Resources:**

* Lesson plan from NY Times Lesson Plan Archive: http://www.nytimes.com/learning/teachers/lessons/20010802thursday.html
* Copy of article http://www.nytimes.com/learning/teachers/featured\_articles/20010802thursday.html
* Dictionary