**Instructional Day:** 16-18

**Topic Description:** Build, program, and present a dancing robot.

**Objectives:**

The students will be able to:

* Use the NXT and output devices to build and program a robot that dances in time to music.

**Outline of the Lesson:**

* Explanation of project guidelines and show dance floor (15 minutes)
* Design, build, and program dancing robot (150 minutes)
* Dance challenge (30 minutes)
* Reflection and cleanup (25 minutes)

**Student Activities:**

* Agree on ideas and music for robot.
* Build robot.
* Write a program in Robot Educator software.
* Test robot and refine program and hardware.
* Participate in dance challenge and discussion.
* Complete project reflection.
* Take robots apart and put materials away.

**Teaching/Learning Strategies:**

* Hand out requirements and rubric. Explain guidelines and answer questions.
* A dance floor can be made out of large square of one or more pieces of butcher paper.
* Circulate and make sure students are on task; answer questions as needed.
* Before the dance challenge, assign one student as timekeeper and another as DJ. Collect each group’s program as they compete and immediately assess the robot using the rubric, while the next group gets set up. You may declare a winner or have the students vote for the best robot.
* Discuss the various dance routines and the features of each. Have students provide comments.
* At the end of the challenge, have each student complete the project reflection and submit it, then clean up the robots.

**Resources:**

* Official RoboCupJunior Dance Challenge rules (2008): <http://rcj.robocup.org/dance.html>
* Dancing Robot Activity
* Dancing Robot Sample Rubric
* Project Reflection

**Dancing Robot Activity**

The dancing robot assignment is based on the first level of RoboCupJunior, an international competition. More information about RoboCupJunior is available at http://rcj.robocup.org.

**Task:**

Build a robot that dances to music for 1-2 minutes.

**Requirements:**

* The robot should not take any input, only have output in the form of various dance moves.
* Dance must be 1-2 minutes long. You have a total of 5 minutes to get set up, have the robot dance, and get out of the way for the next group.
* The robot must stay in the marked space.
* The robot must be autonomous. Other than hitting the start button, no human can touch it while it performs.
* The dance should be choreographed to the music you provide. The music must be appropriate for playing at school—no obscenities, etc.
* Teams may restart the robot up to 2 times at the discretion of the teacher. Any re-started, unless due to a problem not the fault of the team, will result in a grade penalty.
* Teams are encouraged to be as creative and entertaining as possible! Props, costumes, and varied dance moves are encouraged. You may dance alongside your robot.
* Each team must print out its program and hand it in at the same time that they compete.
* Fair play is an important part of the RoboCup competition. Teams are expected to help other teams as needed and not deliberately interfere with or damage other teams’ work. All students are expected to respectfully watch all other teams compete.

**Process:**

1. Brainstorm ideas about how your robot should look, how it should work (wheels? Arms?) and how you’ll build it. Select music.

2. Start building your robot.

3. Build a program that directs the robot to do your dance moves.

4. Test and revise the program. Make sure it runs for 1-2 minutes. Make sure it matches the music. Make sure it won’t fall apart!

5. Show off the robot during the dance in class.

You will have two class periods to build and program the robot, and then you will present it on the third day.

**Performance will be judged on:**

* Programming (e.g.: use of loops, jumps, conditionals, etc)
* Choreography (e.g.: robots to move in time with music, and change actions as music changes tempo or rhythm. Choreography of humans and robots will be scored separately, etc)
* Construction (i.e., robots should be of sound construction, components should not fall off , appropriate use of gearing, smooth and reliable operation, interesting movements, effective use of mechanics to achieve a purpose, etc.)
* Entertainment Value (i.e., How much does the performance entertain or delight the audience? Originality and creativity of the presentation, etc.)
* Costume (Costume of humans and robots will be scored separately.)
* Cooperation between teams

Dance stage will be a flat area. Official RobocupJunior stage size is 6X4 m.

**Dancing Robot Sample Rubric**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Extra Credit | A | B | C | F |
| Programming | Program uses advanced techniques including blocks from the complete palette, flow blocks, etc | Program is straightforward and efficient, using loops and parallel sequences as necessary. Program directs attached output devices to dance. | Program is straightforward and easy to understand. Program is inefficient and could use constructs such as loops. | Program is poorly written or difficult to understand. Program has unused parts or does not correctly control robot. | Pogram does not work. |
| Choreography | Dance has at least 10 different dance moves. Dance matched music precisely. Robot changed actions as music changed tempo or rhythm | Dance has at least 6 different dance moves. Dance is varied and entertaining. Dance is choreographed to match music | Dance has at least 4 different dance moves. Dance is repetitive. Dance lasted for 45-60 seconds or 120-150 seconds | Dance has 3 different dance moves. Dance lasted for 30-45 seconds or 150-210 seconds. Dance did not match music. | Robot did not move or did not appear to dance. |
| Construction | Robot constructed using advanced gearing or other advanced construction techniques. Robot demonstrates extraordinary creativity. | Robot is of sound construction: nothing falls off, robot works as intended. Mechanics used well to achieve dance moves desired. | Robot dances as intended, but some extraneous parts fall off. | Robot does not work as intended, but does move. Robot falls apart. Very simple construction – mechanics not used well. | Robot falls apart or does not move at all. Construction appears careless or haphazard |
| Entertainment Value | Presentation is unusually creative. Humans dance with robot. Costume, props, etc enhance robot. | Audience is entertained by robot, presentation, etc. Robot runs correctly the first time. | Presentation is not smooth: robot must be restarted | Problems occur but robot does eventually run mostly correctly. | Robot does not compete. |
| Cooperation | Student(s) helped other groups | Student worked well with group. Student participated actively in all parts of project | Student worked somewhat well with group. Student participated in most parts of project | Student had trouble working with group. Student participated in few parts of project. | Student did not participate in project. Student sabotaged others’ work. |

**Robot Project Reflection**

For each member of your group, evaluate their performance as a team member:

Name: Circle one word to describe his/her performance

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What was your favorite thing about this project?

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If you could do this project over, what would you do differently?

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